Prediction of pressure bruises susceptibility based on early tuber weight loss in storage

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Summary:

- ✓ Pressure bruise limits the storage duration of potato and reduces grade the longer potatoes are stored.
- ✓ Based on one year study at SLV Research Center, we found correlation between early tuber weight loss (first 3 months) and incidence of pressure bruise in long term storage.
- ✓ Early tuber weight loss mainly depends on cultivar, field and harvest conditions, disease pressure and storage management.
- ✓ Early tuber loss in storage bins can be minimized by bringing down the temperature to holding temperature in 3 to 5 weeks after closing the doors of the bin, while maintaining relative humidity above 95% and applying proper sprout control as required in timely manner.
- ✓ Tests conducted at SLV Research Center revealed significant loss of soil moisture after vine kill and before harvest. This condition will be severe especially in sandy soils.
- ✓ Tubers have little if any ability to absorb water after harvest. The ability of tubers to resist pressure bruise is dependent on minimal water loss prior to and during storage period.
- ✓ Based on our research at SLV Research Center application of ¼" water once in every week maintained the same soil moisture level until harvest preventing loss of water from tubers after vine kill.

Pressure bruise is a primary concern for all market classes of potato and limits the storage duration and reduces grade the longer potatoes are stored. Our idea is to offer a predictive tool to storage manager in deciding the length of storage and time to market quality tubers for premium price. In this experiment we tested whether early tuber weight loss can offer us an indication of pressure bruise incidence in long-term storage. Early tuber weight loss mainly depends on cultivar, field and harvest conditions, disease pressure and storage management.

Tubers were collected after harvest from the piler during bin loading in 10 different commercial storages. 15 tubers per bag were weighed and labeled. They were kept at 6 different locations on

top of the pile in the commercial storage bins along with electronic sensors for humidity and temperature.

Pulp temperature and specific gravity of the tubers were also measured. Subsequently, every month each bag was weighed and once in every 3 months specific gravity of these tubers samples was also recorded. During the bin emptying, 180 tubers were collected randomly and pressure bruises per tuber were recorded. We also collected data from storage managers on the extent of pressure bruise in those bins based on USDA inspector's reports and other data. Data collected from storages that were empty of tubers after 6 months of storage was analyzed.

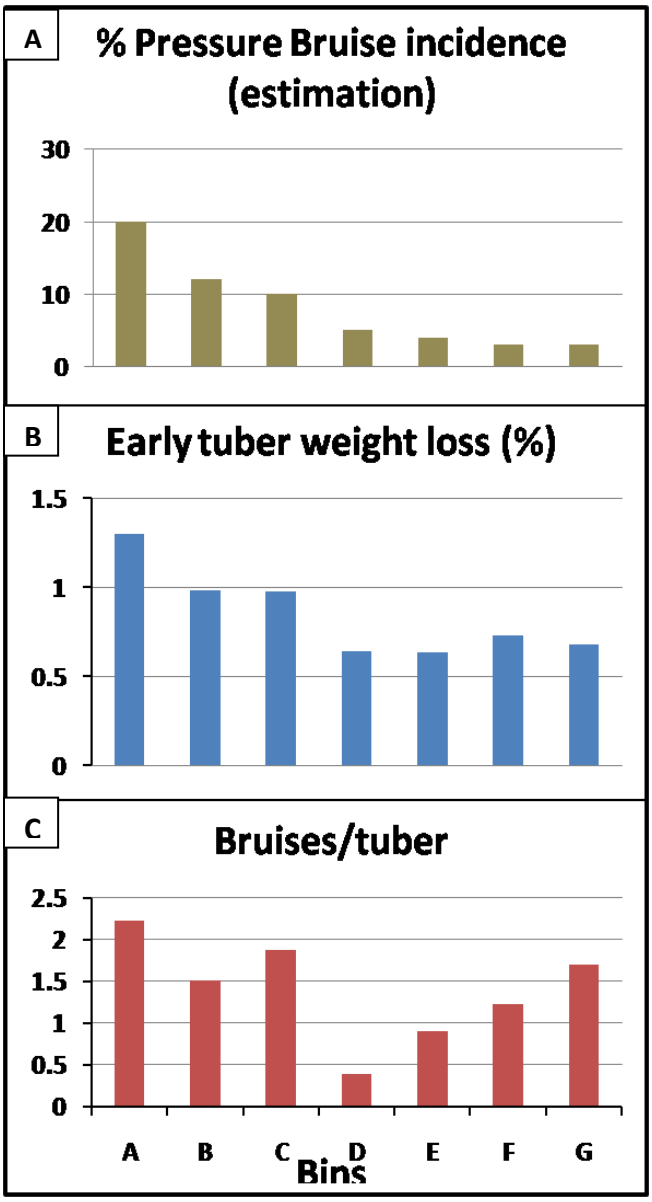

Figure 1: Comparison of early tuber weight loss (B) with pressure bruise incidence (A). At the time of bin emptying tubers were collected randomly and rated for pressure bruise on tubers (C).

Conclusions:

Based on our study this year on 7 different commercial storage bins, we found a good correlation between early tuber weight loss and pressure bruise incidence. Early tuber weight loss (ETL) is calculated based on weight loss that occurred during the first three months of storage. Differences in ETL between the bins ranged from 0.6 to 1.3 (%). These subtle differences in ETL gave an indication of pressure bruise susceptibility. In three commercial storage bins where there was around one or more than one percent ETL, we found 10% or more pressure bruise incidence (Figure 1). The other four bins had only 3 to 5% pressure bruise incidence with a recorded 0.6 to 0.75 ETL (%). Tubers collected from A, B, C and G bins also showed 2 to 1.5 bruises per tuber which coincided with our ETL data. Our results suggest that there is no correlation between pulp temperature and pressure bruise susceptibility in the temperature range that we studied (54 to 65°F) (data not presented). Results based on one year's study indicate that early tuber weight loss (ETL) can be used as predictive tool for susceptibility of the tubers to pressure bruise.

The effects of watering after vine kill on pressure bruise susceptibility and the role of DMN on tuber weight loss during storage

During potato crop growth, as soils become drier the water potential of tuber tissue decreases as transpiration exceeds the rate of water uptake. However, we do not know how well plants or tubers are able to regulate water potential after vine kill or harvest. Tubers have little if any ability to absorb water after harvest. Likewise, we know the ability of tubers to resist pressure bruise is dependent on minimal water loss and subsequent effects on cell turgor pressure. Yet little data is available on quantifying tuber water relations in the field and after harvest. More information is needed on how these factors influence tuber quality such as shrink, weight loss and pressure bruise susceptibility for better storage management.

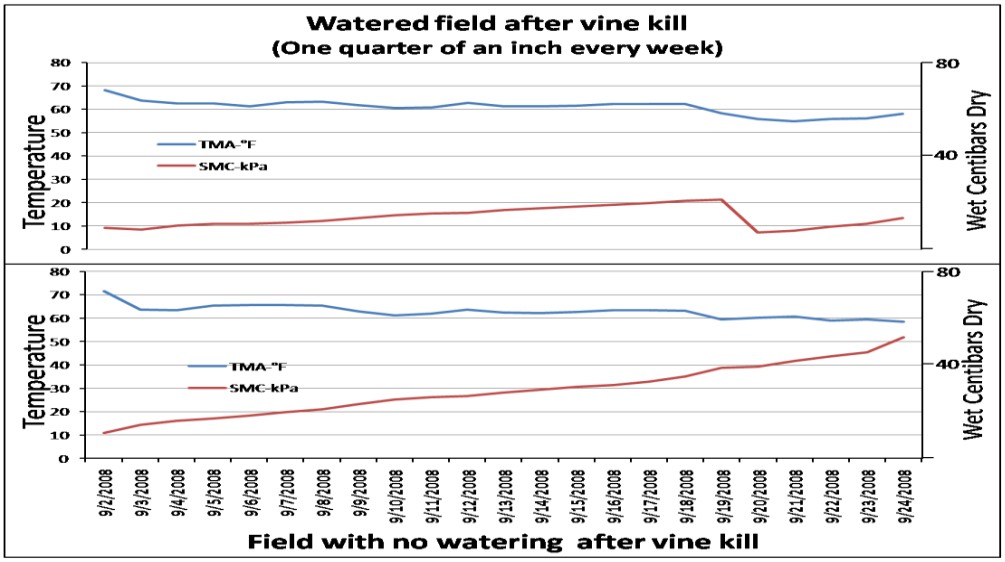

Figure 2: Moisture levels were measured after the vine kill in the potato fields. In both graphs blue line represents temperature and red line represents moisture levels. In case of moisture levels higher the value higher the dryness of the field.

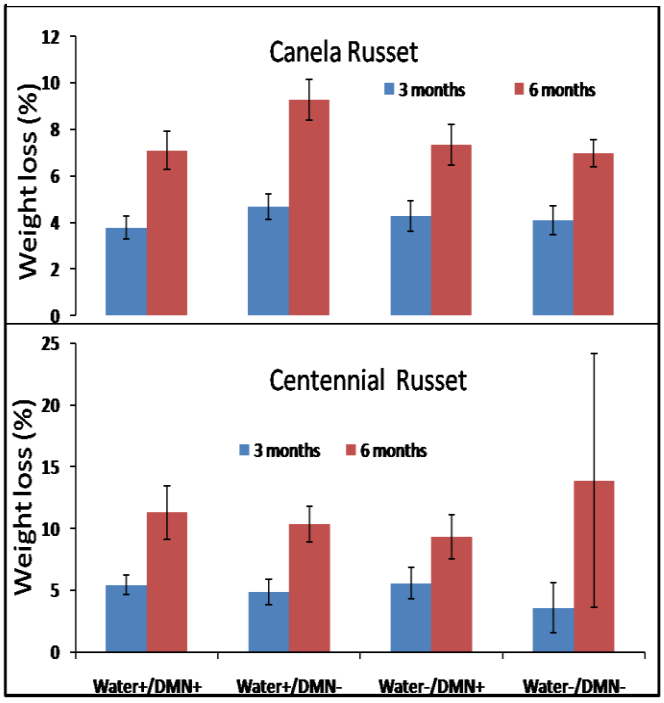

Figure 3: The affect of watering after vine kill and 1, 4-DMN on tuber weight loss in storage.

To understand moisture levels in the soil we initiated experiments using soil moisture probes at SLV Research Center. Potato tubers were harvested after three to four weeks from vine kill. In sandy soils especially, temperatures will go up considerably and may result in dehydration of tubers. We planted both Canela Russet and Centennial Russet at the SLV Research Center and followed recommended practices for irrigation and fertilizer. After vine kill, one half of the field received ¼" of water every week until tubers were harvested. The

other half of the field received no watering after vine kill. We monitored soil moisture using moisture sensors placed at four places in the field. The average soil moisture data after vine kill for the two sides of the field is presented in figure 2. In the watered field soil moisture was maintained between 10 to 20 kPa until harvest compared to in the control field where soil dryness levels increased significantly over a 3 week period.

After harvest, tubers were treated with a 20 ppm concentration of 1, 4-DMN for 24 hours. Tubers were weighed after three and six months to assess the effect of watering after vine kill and DMN treatments on tuber weight loss. 1,4-DMN compound used in combination with CIPC to suppress sprouting.

Conclusions:

There was a significant difference in terms of dryness between fields that were watered and not watered after vine kill. The SLV Research Center has a sandy loam soils. The drying event was severe in the case of more sandy soils and had the potential to significantly dehydrate tubers when day temperatures were high. Tuber weight loss was more in Centennial Russet than Canela Russet. In general, Canela Russet tubers harvested from the watered field and treated with DMN had less weight loss when compared to other treatments. There was no effect of moisture in the case of case of Centennial Russet.

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