PRELIMINARY STUDIES OF SOME FACTORS AFFECTING STORAGE AND PROCESSING ABILITY OF RUSSET BURBANK POTATOES

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Shortly after coming to Pullman last March, I traveled around the Columbia Basin, visited storages and talked to industry people to try to determine the storage problems and how I might best be able to develop a program which would be of help to the potato industry. One of the big problems I was informed was that of high tuber temperatures going into storage. Last fall the highest tuber temperature I recorded going into storage October 1 was around 55° F, which really isn't very high. That problem was certainly solved in a hurry. However, next year I understand we are going to have some high tuber temperatures going into storage, because many of you are going to start digging earlier. You cannot afford the amount of bruising caused by digging cold potatoes which occurred the latter half of the season last fall. Some method of cooling the potatoes will have to be worked out. I think that the possibilities of digging at night and early morning should be considered. Pre-cooling of the storages by continuously wetting down the floor a week to 10 days before harvest will go a long ways toward helping to cool down potatoes. Other possible economical and practicable methods of cooling will be investigated this next fall. I understand that one of our prominent growers is thinking about the use of ice in the plenum. Evaporative coolers which are quite economical may also be a possibility.

Although temperatures were quite cool this last fall I placed thermisters, temperature recording units in 5 storages to determine the progress of cooling of the potatoes. Two of the storages were refrigerated, one had 17 cfm air flow rate and two others had 10 cfm air flow rate. Six pre-weighed bags of potatoes were placed in each storage, two at each level for later determination of storage and processing quality changes.

I have also quite a number of 50 lb bags of potatoes in three controlled temperature storages at Pullman. These are kept at constant temperatures of 42 F, 45 F and 48 F. Some potatoes were placed immediately into 42 F storage after harvest, others were kept at 50-55 F for 3 weeks before placing in 42 F storage. Initial data indicate that greater amounts of reducing sugars are built up when potatoes are rapidly cooled than when gradually cooled over a two to three week period.

This has also been observed by other research workers. Greater initial weight loss also seems to occur when potatoes are rapidly cooled because of the slower rate of suberization.

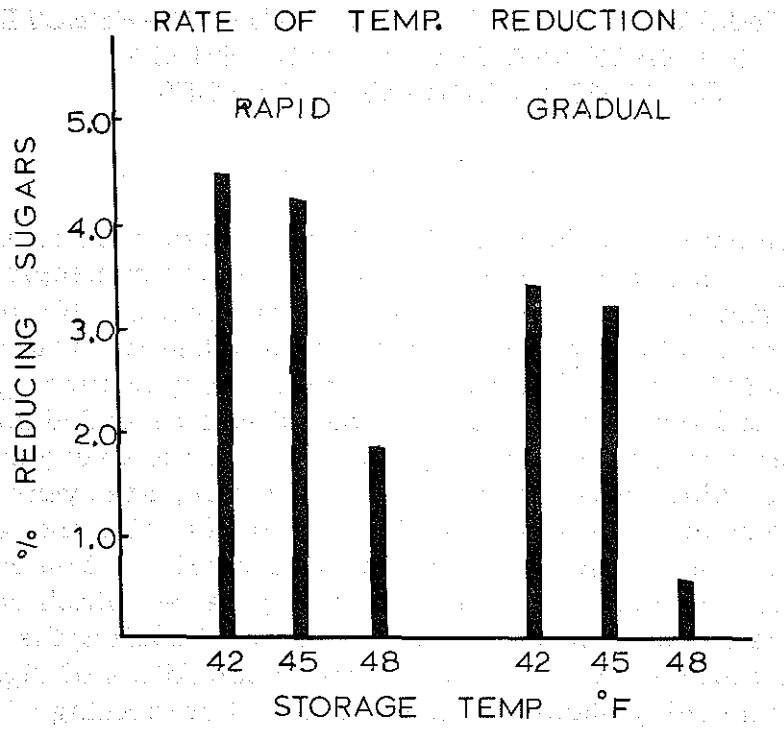

Figure 1. Effect of rapidity of cooling from 55° to the above holding temperatures on sugar accumulation after one month storage.

I am also conducting some research on the effect of maturity of tubers as determined by how long vines were dead and the amount of skinning, on storage and processing ability of potatoes. I have one lot in which the vines were dead over a month before digging. This lot I call over-mature. The vines of the mature tuber lot were 30% dead at the time of killing with a desiccant two weeks before harvest. Tubers of the immature lot were dug two days after green vines were beat off. Figure 2 shows the reducing sugar accumulation one month after storage of each of the lots. It appears that maturity has some effect on initial sugar accumulation. Both immature and over mature potatoes accumulated reducing sugars faster than the mature potatoes. Also at the lower storage temperatures, as would be expected, there were higher sugar accumulations.

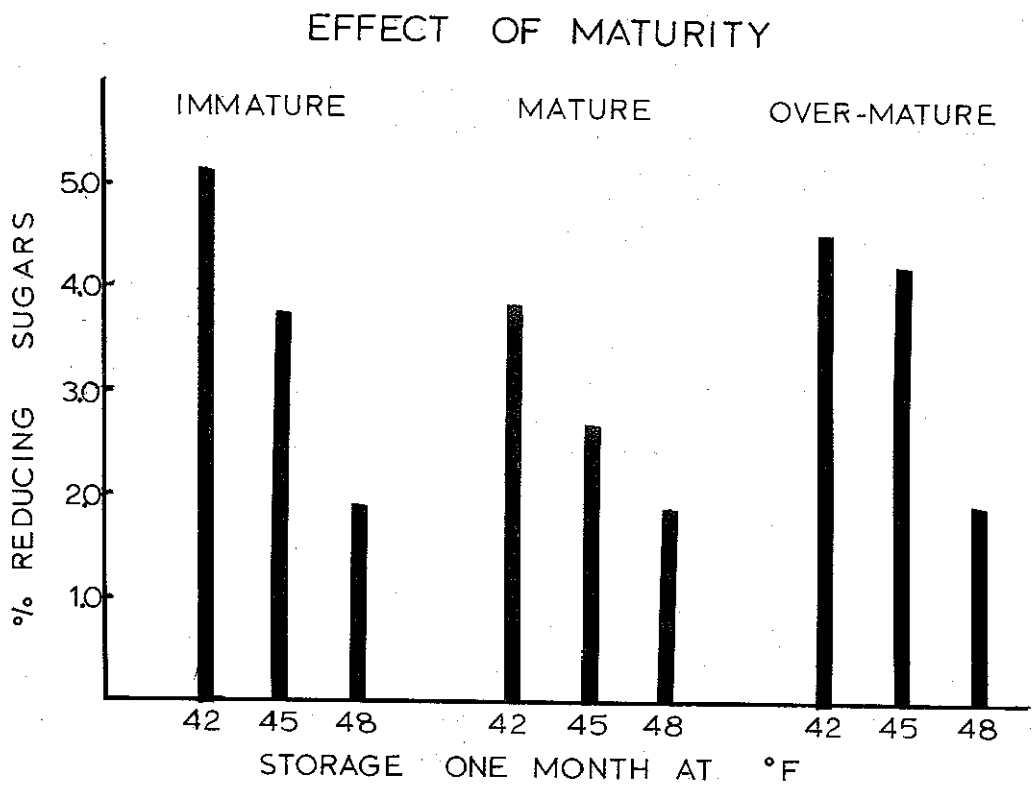

Figure 2. Effect of tuber maturity on sugar accumulation.

Table 1 shows the effect of maturity as determined by fertilizer rates on percent total and reducing sugars of two varieties after two weeks storage at 38 F (from Dr. Robert Kunkel's trials).

Variety	% Sugars Total	% Sugars Reducing
Kennebec		
100 Lbs NPK	2.48	2.06
400 Lbs NPK	2.38	1.61
Russet B.		
100 Lbs NPK		
Stem End	4.56	4.16
Bud End	3.15	1.88
400 Lbs NPK		
Stem End	3.72	2.64
Bud End	2.56	----

Table 1. Effect of maturity as determined by fertilizer rates on sugar accumulation.

The plots receiving 100 lbs of NPK were dead approximately a month before the heavier fertilizer treatments. The assumption that the effect here is primarily due to maturity is a valid assumption since Dr. Kunkel has not been able to find any influence of fertilizer rates per se on chip color when tubers were harvested the latter part of the season. With both varieties the more mature potatoes (100 lbs NPK) initially developed greater amounts of sugars in storage. In the Russet Burbank variety the stem end at both fertilizer rates developed considerably more sugars than the bud portion.

Test-tape (Figure 3) obtainable in most drug stores and used by diabetics for determination of sugars in urine appears to be a good tool by which a grower can roughly tell how much reducing sugars are present in his potatoes. Upon application of the tape to a cut portion of a tuber the tape

color will change from yellow to various shades of green depending upon the concentration of sugars present. When the tape turns the darkest green indicated on the chart (on the dispenser) then in all probability reducing sugars are greater than 2% on a dry weight basis which generally will not produce acceptable color processed products.

Research has been initiated on the problem of sugar ends in Russet Burbank potatoes. That is, high reducing sugar forming at the stem end of the tuber causing that end to fry dark while the bud end remains light in color. Nothing is known of its cause except that it appears worse in years of high summer temperatures. Since Norgolds do not generally develop sugar ends, they, along with Russet Burbank Tubers, were harvested twice a week during the development and maturing period and

the stem and bud ends analyzed separetely for sugar and dry matter changes. It was found that in the Norgold variety, all through the sampling period, the bud end had the highest sugar content (primarily sucrose). After storage

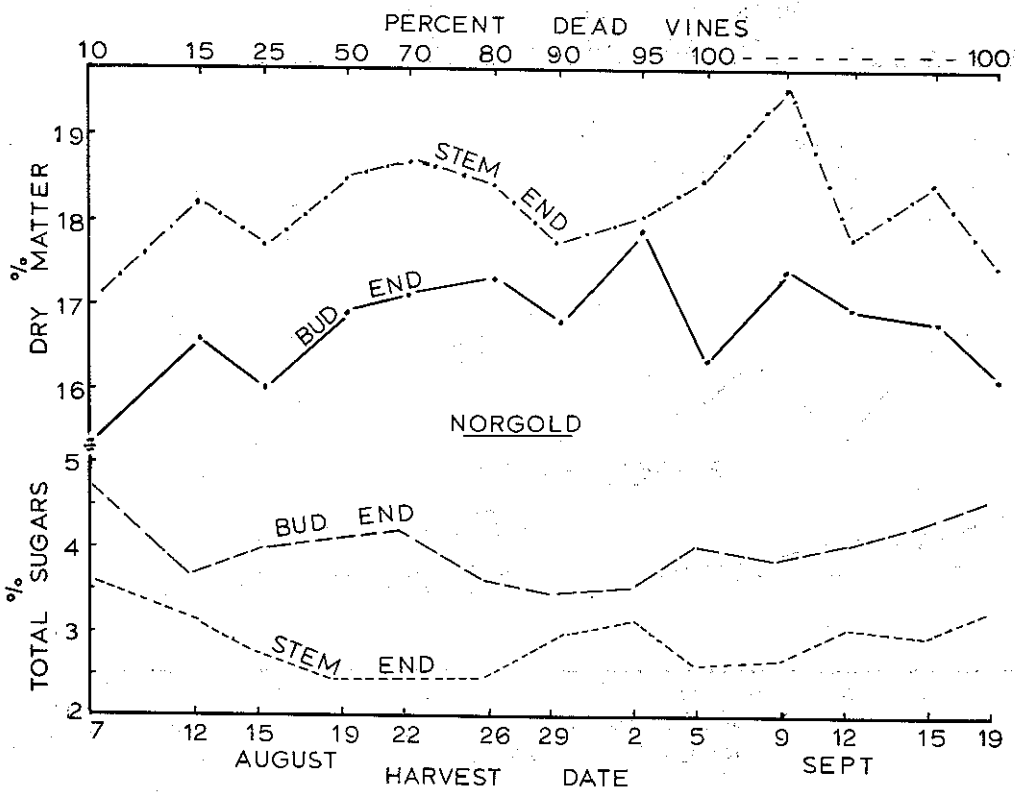

Figure 4. Dry matter and sugar changes during growth and maturity of Norgold potaotes.

the bud end initially had the highest reducing sugars. However, later in storage the stem end developed as much sugars on a dry weight basis.

Russet Burbank tuber behavior was different. Initially during the developing and maturing period the bud end had the highest amount of sugars. However, when the vines were about 85% dead a switch occurred and the stem end turned up with the greater amount of sugars. The reason or implications of this are not known. The development of sugar ends may or may not be connected to this occurrence. These studies will be continued. Preliminary data indicates that after storage the stem end has a greater capacity to produce reducing sugars than the bud end, possibly because of the higher dry matter content.

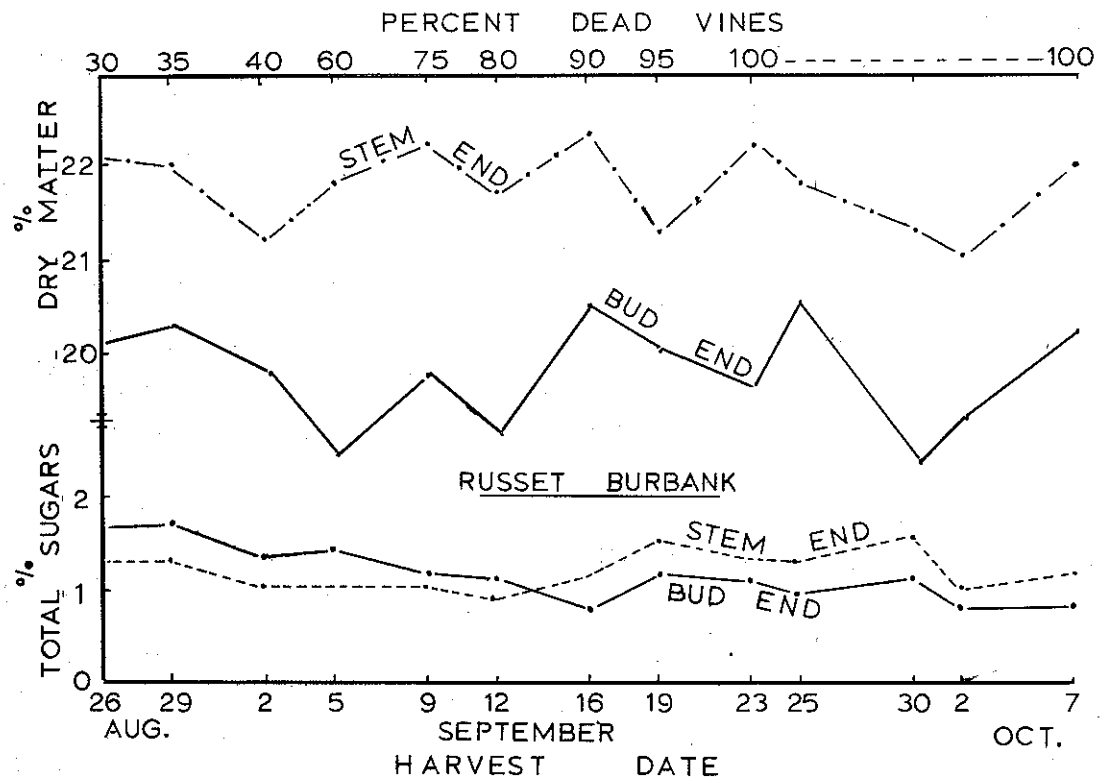

Figure 5. Dry matter and sugar changes during growth and maturity of Russet Burbank potatoes.