

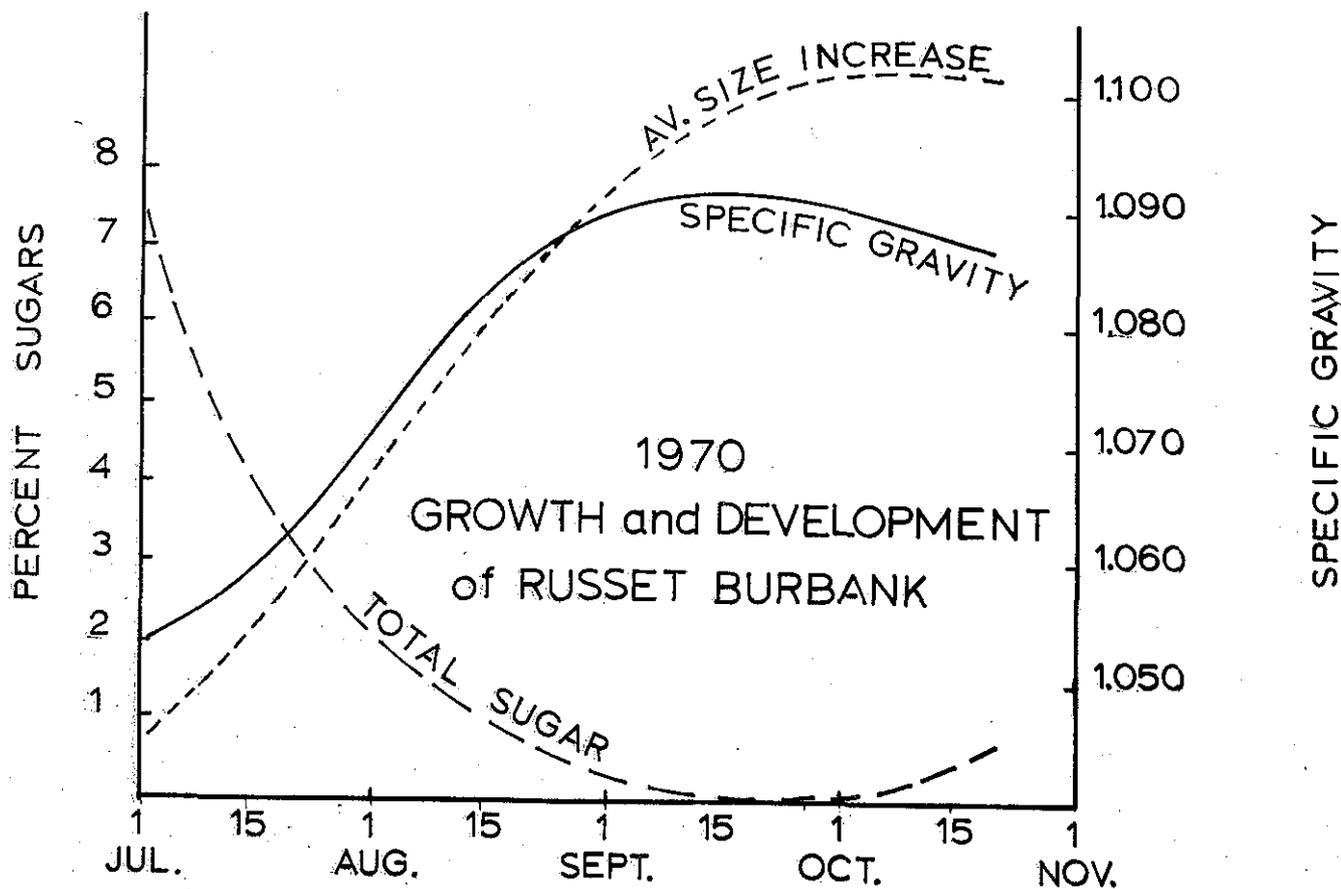
## STORING POTATOES FOR PROCESSING

W. M. Iritani and Larry Weller

According to the survey made by the Washington Potato Commission we now have a storage capacity in the Columbia Basin of over 1 million tons of potato. Of the potatoes which went into storage last year approximately 88% were processed. Therefore, any research which is done on storage necessarily emphasized the effect of storage environment on processing qualities. Quality is becoming increasingly more important as competition gets keener for marketing fresh and processed potatoes. What is required of a processed potato is applicable for fresh potatoes. However, the reverse may not necessarily be true.

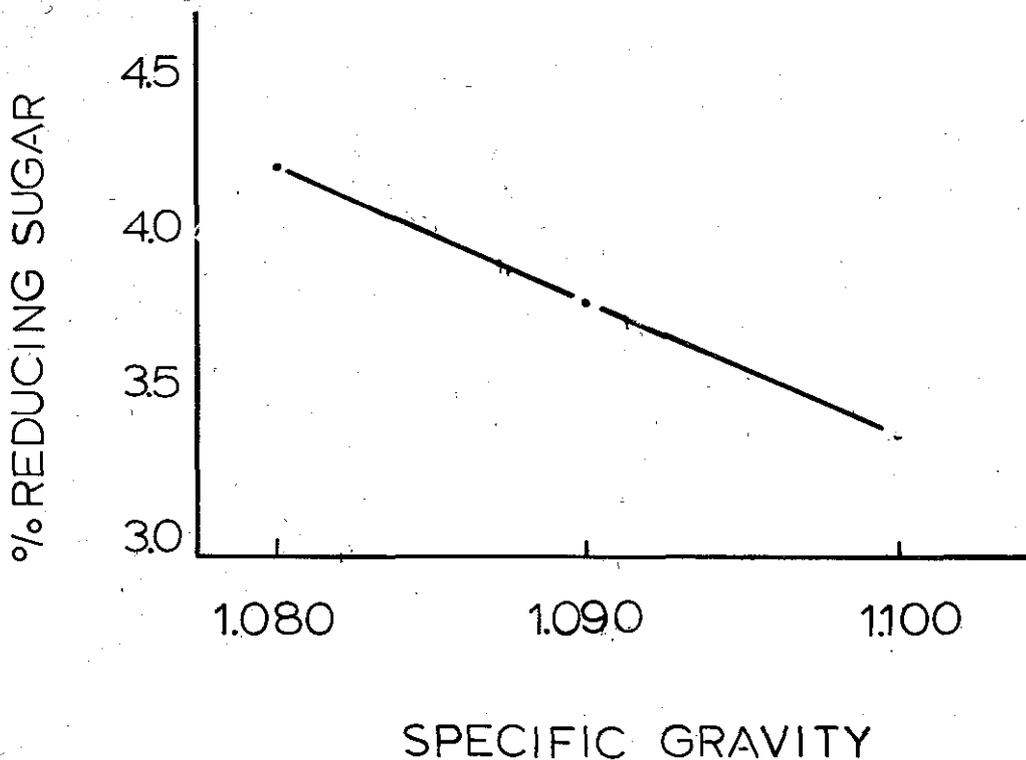
Storage never improves quality only maintains it. For this reason it is important to place in storage high quality potatoes which are free of blemishes, bruises and of proper maturity. What is the proper maturity? The last several years Russet Burbank potatoes were harvested twice a week from July 1 until the middle of October. They were analyzed for sugars and determinations were made on specific gravity and size increase. As shown in Figure 1 a peak in specific gravity was reached approximately the middle of September shortly after the sugar content reached a minimum.

Figure 1. Changes in sugar content (primarily sucrose), specific gravity, and size as Russet Burbank tubers grow, develop, and mature.



Size increased until about the last of September. It would appear from these results, that this particular field was ready to prepare for harvest about the middle of September when specific gravity achieved a peak and sugar content was minimum. Similar results were obtained in 1969. For processing potatoes, high specific gravity and low sugar content are very desirable. As can be seen in Figure 2, high specific gravity potatoes accumulate less sugars in storage than low gravity potatoes. These are sugar accumulations after 3 weeks storage at 42° F.

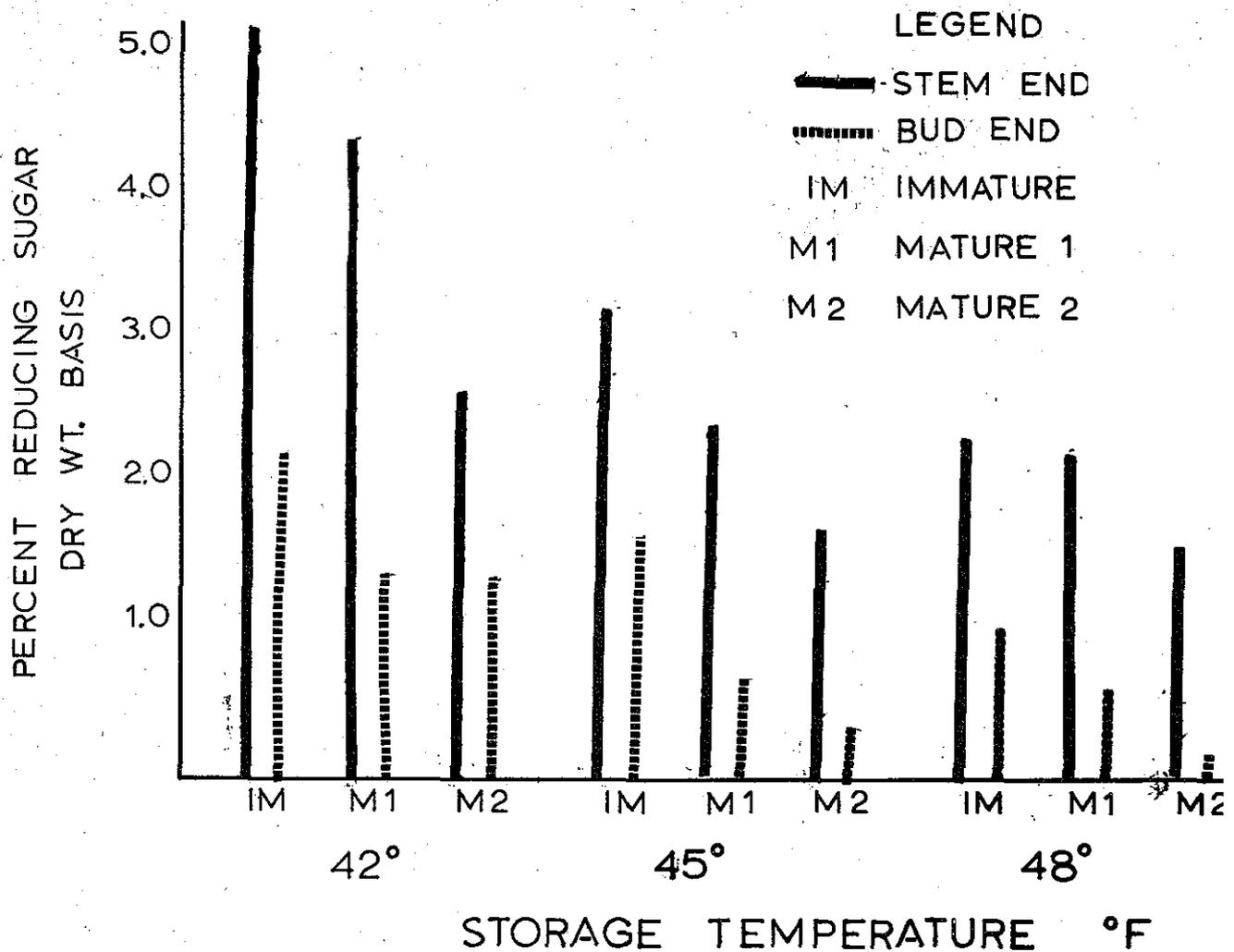
Figure 2. Effect of specific gravity on sugar accumulation after approximately 3 weeks storage.



The vines should be killed at this time to enhance setting of the skin or periderm. This also is a part of maturity. Undoubtedly, internal physiological or biochemical changes take place during the setting of the periderm which are not known at this time. Some sacrifice, of course, will be made in yield. With the tendency for overproduction every year, quality is going to have to take precedence over quantity.

What effect does maturity have on storage and processing ability? Potatoes of different maturities as determined by length of growing period were harvested and placed in controlled temperature storages of 42°, 45°, and 48° F. Results are presented in Figure 3.

Figure 3. Reducing sugar accumulation in stem and bud portions of tubers of different maturities stored at 3 temperatures.



The immature lot (133 days from planting to harvest) accumulated significantly more sugars at 42° and 45° F storage than either M1 (155 days) or M2 (180 days from planting till harvest). At 48° F storage the differences were not as great. The stem portion accumulated over twice as much sugar as the bud portion regardless of maturity or storage temperature. The reason for this is not known. It appears to be a variety characteristic or is a characteristic of long varieties. Potatoes can become over mature. By this is meant tubers from vines which have died prematurely. Table 1 shows sugar accumulation after 2 weeks storage at 42° F of tubers from two fertilizer rates. (From Dr. R. Kunkel's fertility trial).

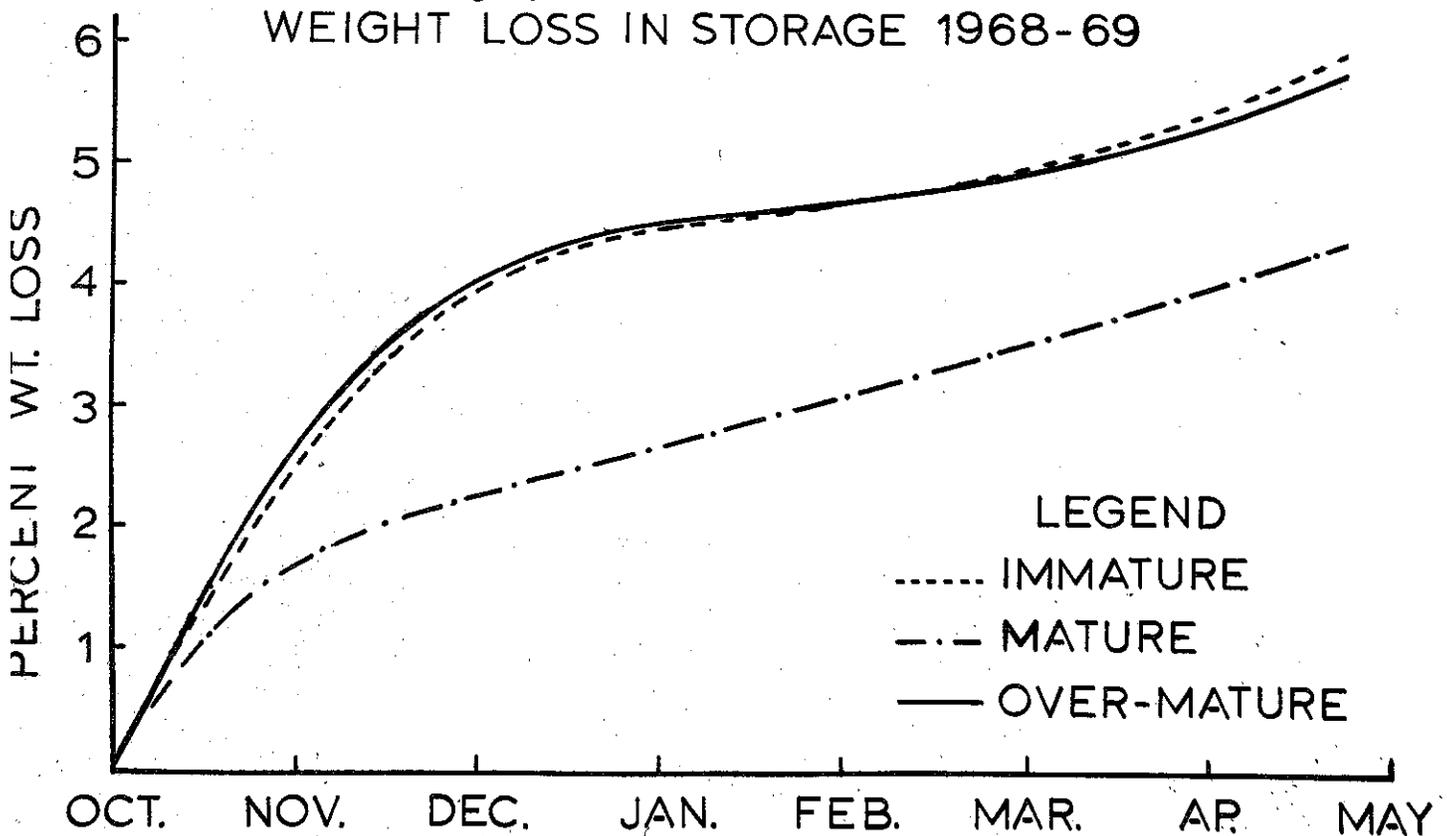
Table 1. Effect of maturity as influenced by fertilizer rates on sugar accumulation after 2 weeks storage at 42° F.

Variety	Fertilizer rate	% Sugars	
		Total	Reducing
Kennebec	100 lbs. NPK	2.48	2.06
	400 lbs. NPK	2.38	1.61
Russet Burbank			
Stem portion	100 lbs. NPK	4.56	4.16
Bud portion	" " "	3.15	1.88
Stem portion	400 lbs. NPK	3.72	2.64
Bud portion	" " "	2.56	0.00

At the 100 lb. fertilizer rate (vines died prematurely) significantly more reducing sugars accumulated than at the 400 lb. rate for both Kennebec and Russet Burbank. It appears that more attention will have to be paid in the future to harvest potatoes in prime condition for best storage and processing qualities.

As would be expected, maturity has an effect on weight loss in storage (Figure 4.)

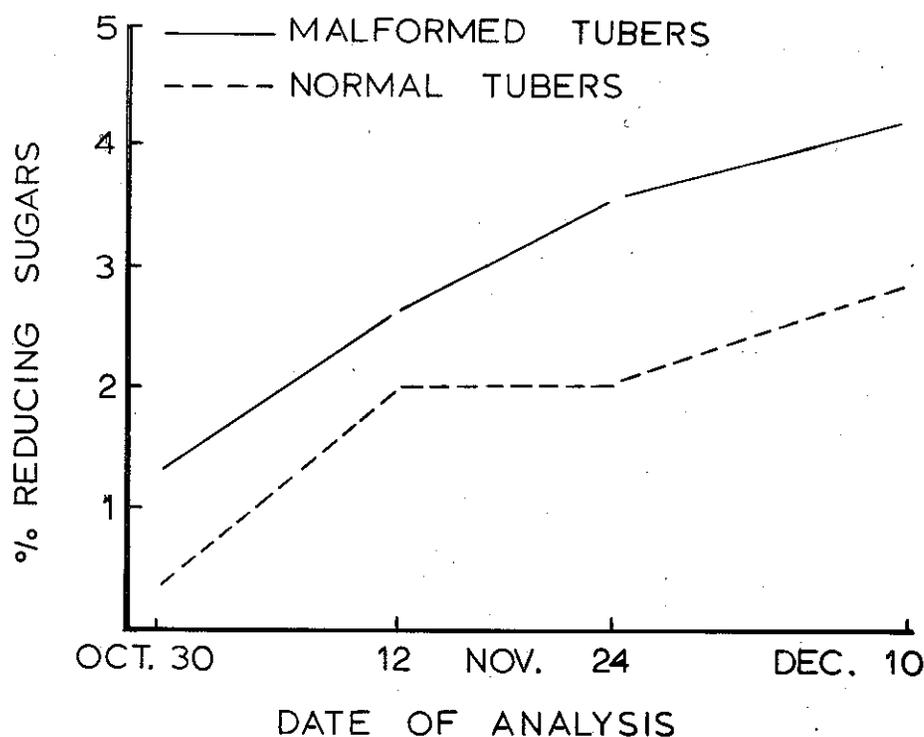
Figure 4. The effect of maturity on weight loss in storage. Over-maturity indicate tubers which had died prematurely. Immature lot harvested while vines were green and several weeks earlier than mature group.



Both the immature and over mature lots lost significantly more weight over the storage season than the mature group.

A lot with considerable amounts of malformed tubers should not be stored for processing because of greater sugar accumulation in storage.

Figure 5. Differences in amount of reducing sugar accumulation in storage of malformed tubers in comparison to normal tubers.



Conditions of high temperature or moisture stress during tuber development which cause malformed tubers also tend to enhance occurrence of sugar end potatoes (high sugars in one end of the tuber which causes uneven fry color).

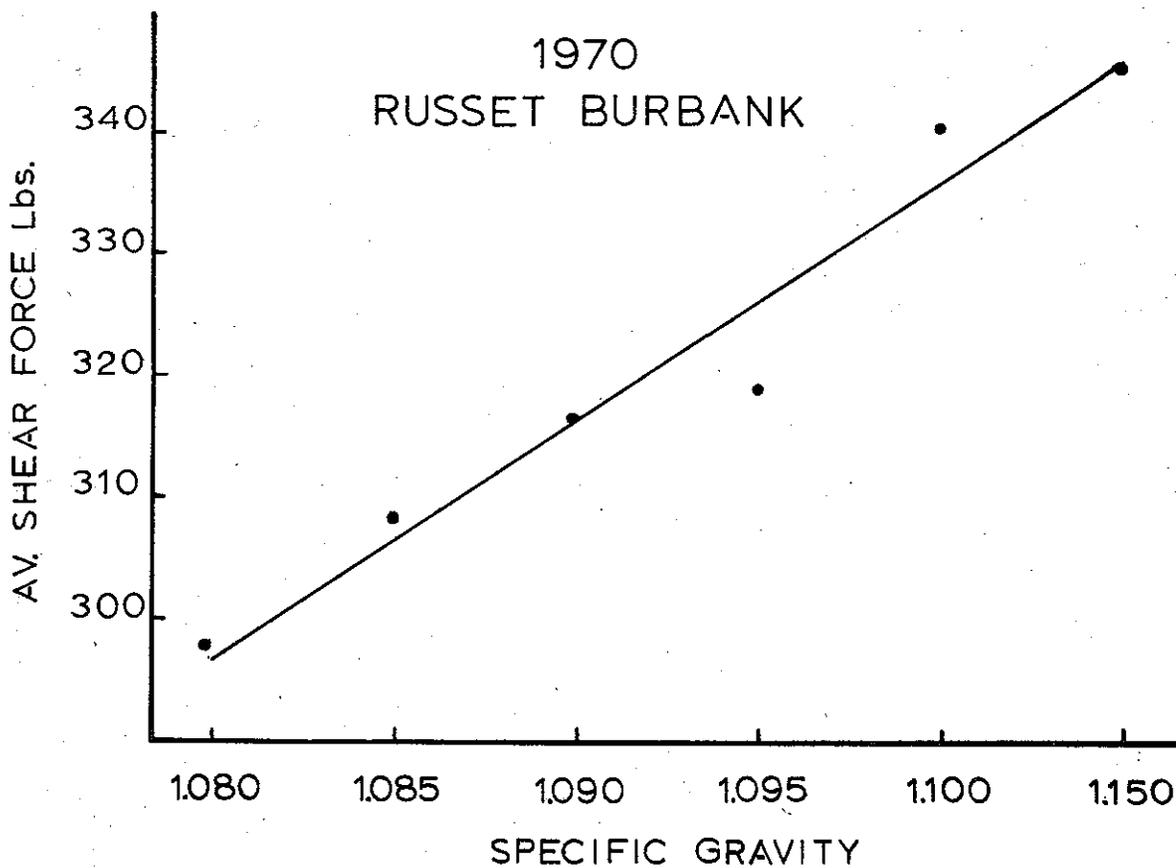
It is important to maintain high humidity in potato storages for several reasons. First of all, immediately after harvest high humidity is essential for suberization or wound healing to take place. In order to prevent progress of rot, bruises have to be properly suberized. Excessive weight loss and dehydrated tubers because of low humidity are undesirable not only because it would mean monetary loss to the grower but flabby tubers are difficult to peel and blanch properly. Flattening or pressure bruising is also the result of excessive weight loss due either to low humidity or immaturity of tubers.

What is the most desirable storage temperature? Generally, the recommended temperatures are a compromise between temperatures which are high enough to prevent sugar accumulation and that which is low enough to keep decay and weight loss to a minimum. Temperatures of around 45° to 48° F have been found to be desirable in the Columbia Basin. Constant temperatures are better than fluctuating. Storage at these temperatures, for more than several months, requires the use of sprout inhibitors.

In the making of dehydrated mash potatoes it is important to have bright white flesh color. Very little is known of factors which affect flesh color of tubers. One of the factors which has been observed is temperature. Low storage temperatures have been observed on occasion to cause off-white (slightly yellow) flesh color to occur on Russet Burbank. Apparently, some varieties and seedlings are more susceptible than others. Other unknown factors are probably involved in combination with temperature and variety, or separately, in influencing flesh color.

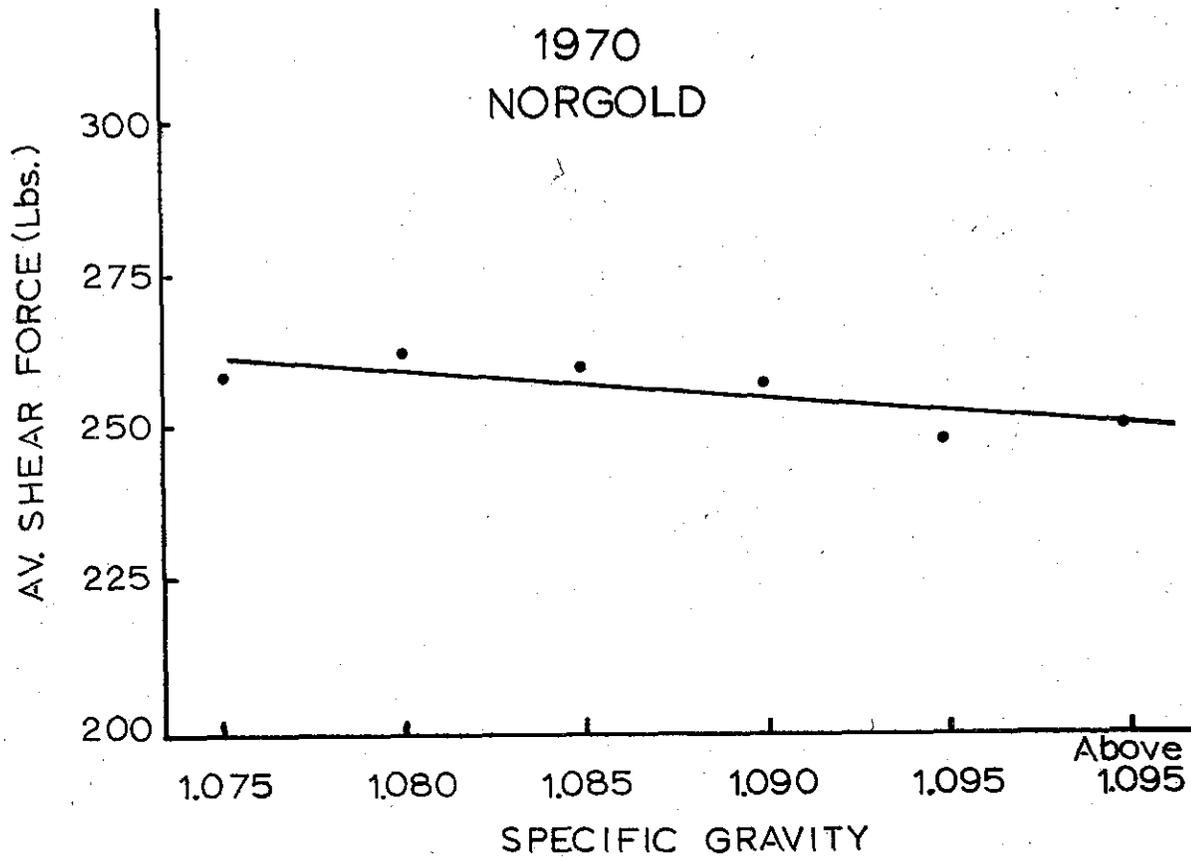
Another quality factor of which very little is known and which will become increasingly more important in the future is texture. Generally, a dry mealy texture is desired of the Russet Burbank potato. Desirable texture seems to be associated with high specific gravity. However, if results from shear press\* readings are any indication of texture, then other factors besides starch content are involved in influencing texture. Tubers harvested at the same time were separated into different specific gravity groups with brine solutions and shear press readings determined. The results are presented in Figures 6 and 7.

Figure 6. Shear press readings as influenced by specific gravity of Russet Burbank potatoes.



\* Instrument used for an indication of textural qualities on many fruits and vegetables either of the raw or processed form. Measures force required to shear or cut across layers of cells.

Figure 7. Effect of specific gravity of Norgold potatoes on shear force readings.



In the Russet Burbank variety as specific gravity increased, shear force increased. In the Norgold variety (Figure 7) no increase in shear force readings were obtained with increase in specific gravity. The Norgold variety is considerably less desirable for processing than Russet Burbank. These results may give an indication as to the reason why, although, one of the factors is overall lower starch content in the Norgold variety.