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STORAGE OF IMMATURE RUSSET BURBANK AND SHEPODY POTATOES

Introduction

Proper storage management is essential to ensure acceptable quality of potatoes for processing. Storage practices may need to be altered in order to improve processing quality of potatoes harvested before reaching a suitably mature stage. On occasion, weather or management practices may delay maturity while prompt harvest is necessary to avoid autumn frosts. Alternative storage management steps may then be needed to ensure tuber immaturity does not affect processing quality.

Tuber maturity

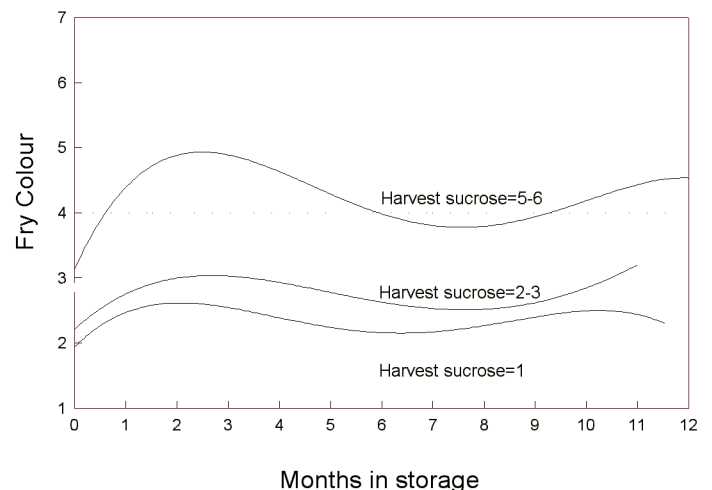
Sugar in the form of sucrose is transported from the leaves to tubers during growth. Sugars in tubers are high during bulking and decrease as the plants are terminating growth. Potatoes are 'chemically mature' when the free sugars in the tubers have decreased to a minimum level and usually corresponds to the time of maximum dry matter accumulation. 'Physical maturity' on the other hand refers to the stage of development in which the periderm has developed irrespective of sugar composition.

Colour of processed potatoes

The colour of processed potato products is determined by the concentration of the reducing sugars, glucose and fructose, in tubers. High reducing sugar content results in darkening of the product during frying due

to a reaction with the amino acids in the tuber. Tubers of Russet Burbank and Shepody which have been harvested chemically mature usually will produce acceptable processed products out of long term storage. Reducing sugars may exceed acceptable levels if tubers have been harvested while chemically immature. Reducing sugars may also increase in tubers that have been exposed to low temperatures, have been starved of oxygen, or have been physically damaged.

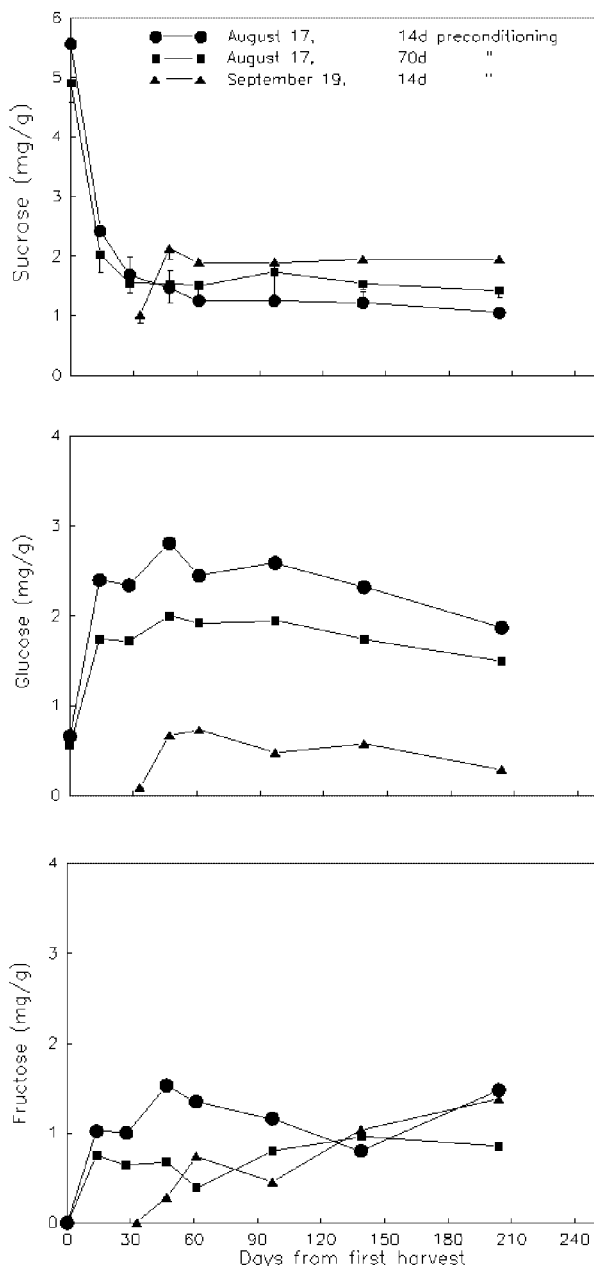
Figure 1. Fry colour during storage at 8°C (46°F) of Russet Burbank harvested with different sucrose contents (mg/g) and preconditioned for 14 days. Area below dotted line represents acceptable colour (See Table 1).



Sucrose at harvest

Sucrose content at harvest is a good indicator of processing performance from long term storage. If sucrose is high at harvest, the reducing sugars will increase significantly during storage and result in unacceptable fry colour (Figure 1). Tubers with sucrose less than about 2.8 milligrams per gram (mg/g) fresh weight should produce acceptable processing quality out of long term storage.

Figure 2. Sugar changes in Russet Burbank harvested on two dates and preconditioned for 14 or 70 days at 15°C (58°F) before storage at 8°C (46°F)



Sugar changes in storage

After harvest, sucrose in healthy potatoes generally decreases to 1-2 mg/g and remains stable during storage at 8 °C (46 ° F) whether or not the tubers are chemically mature at harvest (Figure 2). However, tubers which have sucrose less than 1.5 mg/g at harvest may experience a slight, temporary increase in sucrose early in storage. French fry colour can be estimated when the glucose concentration is known. Generally, glucose is low at harvest (less than 1 mg/g) and increases to a maximum after approximately 30-60 days in storage with the extent of the increase dependent on how chemically mature tubers are at harvest. During the remainder of storage, glucose decreases or remains at a low level.

Preconditioning

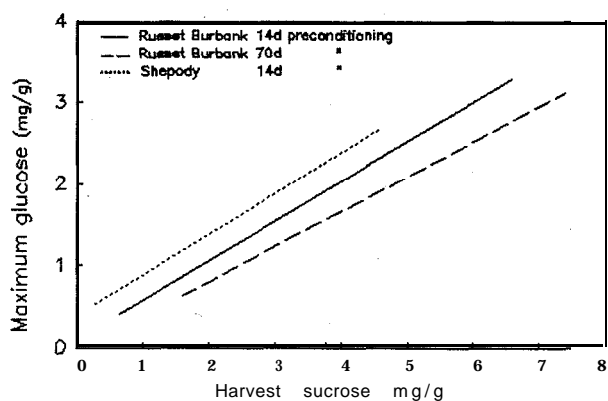
Preconditioning or curing tubers after harvest aids in skin set which reduces moisture loss and disease development in storage. Holding tubers near 15°C (59° F) with RH near 90% for about 14 days after harvest is a common preconditioning practice in Manitoba. These conditions allow thickening of the periderm and the deposit of a waxy material called suberin within the outer cells which provides a physical barrier to moisture loss. If sucrose is high at harvest, it may take several months in storage before the reducing sugars decrease to a level acceptable for processing. Extended preconditioning, by holding tubers at high temperatures for up to several weeks, minimizes glucose accumulation and lowers it more quickly than does a shorter preconditioning period (Figure 2). Some of the sugars are converted to storage starch while some are utilized in the respiration process. The length of preconditioning will depend on the sucrose content at harvest.

About 70 days of preconditioning is necessary to prevent excessive glucose accumulation in tubers harvested with a sucrose of 5-6 mg/g. If sugars are very high at harvest however, prompt marketing may be preferred. The maximum accumulation of glucose in storage is predictable if the sucrose at harvest is known (Figure 3). Glucose of greater than 2 mg/g will result in a colour rating of french fries which may result in loss of bonus payment to the producer.

The response of tubers in storage may be affected by field stresses such as exposure to excessive heat. Extended preconditioning would not be recommended for diseased tubers or those which have been damaged by frost. Early marketing of such tubers would be recommended. Different cultivars will also respond slightly differently in storage.

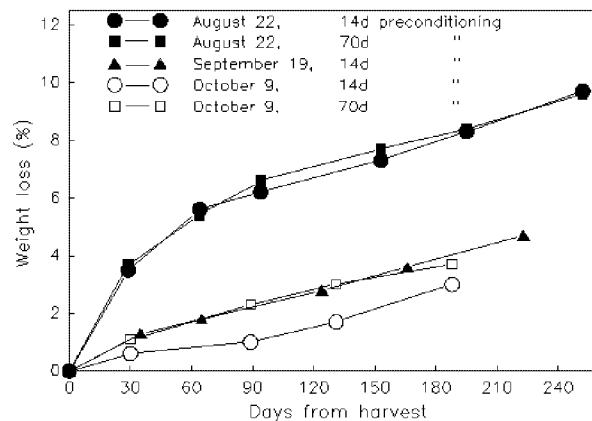
Weight loss during preconditioning
 Extended preconditioning increases the chance of weight loss due to increased

Figure 3. Maximum glucose accumulation during 8°C (46°F) storage of Russet Burbank and Shepody potatoes harvested with different sucrose contents.



respiration and water loss. The more physically and chemically immature the tubers at harvest, the greater the weight loss during storage. While extended preconditioning of immature potatoes does not increase weight loss, it does increase weight loss of tubers which are mature at harvest (Figure 4). About half of the weight loss from the early harvested tubers occurs within the first 50 days of storage. The additional weight loss caused by preconditioning may be justifiable if processing quality is improved.

Figure 4. Weight loss during 8°C (48°F) storage with 14 or 70 days preconditioning at 15°C (59°F) in high RH of Russet Burbank tubers harvested at different dates.



Russet Burbank versus Shepody
 Chemical maturity at harvest is of little concern for Shepody in Manitoba because of its early maturity. At an equivalent sucrose content at harvest, Shepody will accumulate more glucose in storage than will Russet Burbank. In addition, at an equivalent glucose content, french fries from Shepody will be slightly darker than those from Russet Burbank.

Table I. Relationships of french fry colour scales used in Manitoba.

USDA colour chart	000	00	0	1	2	3	4	
University of Manitoba	1	2	3	4	5	6	7	
Carnation Foods Co. Ltd.			0	1	2	3	4	
McCain Foods Ltd.				1	2	3	4	5

Prepared by:
M.K. Pritchard
Department of Plant Science
University of Manitoba
Winnipeg, MB R3T 2N2
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