Storing The Sugar

Sugarbeets grown by American Crystal Sugar Company growers are harvested quickly and stored up to 250 days to await delivery and processing. It is during this storage period that sucrose is used as an energy source in normal respiration. It is estimated that respiration causes about 70% of sugar loss during storage, and decay (Fig. 1) accounts for 10%. The remaining 20% of sucrose losses are the result of fermentation (Fig. 2) when oxygen content is low because of poor ventilation, freezing and thawing cycles, and root desiccation.
Storage losses caused by respiration have been controlled through the utilization of forced-air ventilation and subsequent freezing of storage piles after mid-December. Also, pile splitting has been implemented to reduce the insulation value of the pile and provide root preservation.

In order to minimize the 30% losses caused by decay and fermentation, acceptable storage standards must be set, regulated and controlled by the Agricultural staff of American Crystal Sugar Company, through individual load inspection stands (Fig. 3). Growers delivering loads containing improperly deflated beets, excessive dirt, or weeds, resulting in a load unacceptable for storage, will be issued a written warning. (Fig. 3a)

**Paragraphs #9 and #10 of the Five Year Agreement state the following:**

**#9** DELIVERY OF BEETS SHALL BE MADE BY GROWER AT SUCH TIMES, IN SUCH QUANTITIES, AND TO SUCH RECEIVING STATIONS AS MAY BE DESIGNATED BY COMPANY. Title and all risk of loss to said beets shall be and remain with Grower until title and risk of loss passes to Company when Grower completes delivery. The beets shall be protected from sun and frost after removal from ground, including beets that are loaded on trucks. Company has the option of rejecting any diseased, frozen or damaged beets, beets less than 12% sugar, or less than 80% purity, beets which, in Company’s opinion, are not suitable for storage or for the manufacturer of sugar, beets as to which, in Company’s opinion, the terms and conditions of this agreement have not been properly complied with or for any other bona fide reason.

**#10** All beets delivered shall be properly topped and free from excess dirt, stones, trash and other foreign substances of any kind which might interfere with handling and processing at Company’s factories. All beets shall be subject to a deduction for tare. Tare determination, sugar percentage, and sugar loss to molasses shall be determined at quality laboratories operated by Company.
Proper Defoliation

The occurrence and origin of decay is much greater in roots that have been wounded during harvesting. Traditionally, crown tissue had been removed at harvest, because it contained a high amount of impurities, which increased sugar loss to molasses. The removal of this crown tissue exposes the most vulnerable pith tissue to decay. Excessive crown removal (Fig. 4) results in two to three times more decay (Fig. 4a) and an increase in respiration. The amount of decay originating at wounds at the tip of the taproot and on the body of the root does not significantly increase during storage, but decay in the crown area continues to advance and eventually accounts for a major portion of the total area of decay. Thus, proper defoliation should minimize the wounding of the crown area through correct scalper adjustments (Fig. 4b) or scalper elimination (Fig. 4c) while maintaining delivery of a foliage-free beet.
Poor ventilation is often the result of dirt, weeds and leaf trash. These enemies of storage quality are usually controllable through both cultural and mechanical means.

One of the greatest threats to proper ventilation is dirt (Fig. 5). It is this storage enemy which can be controlled through mechanical means. Through the utilization of current technology, scrubber chains, grab rollers, etc., the amount of dirt being delivered to receiving stations has been greatly reduced. Occasionally, improper operation of harvesting equipment results in loads containing excessive dirt. Any loads containing dirt amounts in excess of the cleaning capacity of the beet receiving equipment or the re-delivery of previous tare will be considered unacceptable for storage. (Fig. 5a)

Loads containing excessive weeds (Fig. 6) will be unacceptable for storage. Weeds ride over the screen area of the piler and are put directly into storage, causing immediate ventilation problems. This storage hazard can best be controlled throughout the growing season through proper cultural practices and correct operation of harvesting equipment.

Leaf trash (Fig. 7) occurring in loads is unacceptable for storage. This storage problem can often be easily corrected through proper maintenance and/or operation (speed, adjustments, etc.), of the defoliator. Poorly defoliated fields, (Fig. 7a) will result in the subsequent rejection of loads for storage.
Heat

General Heat Policy

When the air temperature reaches 55°F, temperature monitoring of beet roots will begin. If the air temperature is rising and the root temperature reaches 55°F, harvest will be stopped. **No loads will be accepted after the time prescribed by heat shutdown policy. Rotobeating and truck loading should cease.**

Exceptions for Ventilated Piles

For sites with ventilated piles, beets will be accepted with higher root temperatures, providing all of the following criteria are met:

- Beet root temperatures are 65°F or less.
- Predicted nighttime low temperatures are forecast to be 45°F or lower within 60 hours.
- There is storage capacity at the station.

Exceptions for 20-Foot Piles

At sites with 20-foot piles, stockpiling may be allowed at the discretion of the Harvest/Maintenance Supervisor or his assistant. The decision will be made based on the following criteria:

- Root temperatures are between 55 and 65°F.
- Predicted nighttime low temperatures are forecast to be 45°F or lower within 60 hours.
- Width of pile. Narrower pile width will allow better natural ventilation.
- Dirt and trash load is low so natural pile ventilation is not hampered.
- Total warm tons already received.

If the criteria regarding ventilated or 20-foot piles is not met, the heat shutdown policy will go into effect when root temperatures reach 55°F. Once a heat shutdown is in place, monitoring of root temperatures will continue and stockpiling will resume only when root temperatures have fallen below 55°F. This policy will minimize the development of storage rots and hot spots in the piles (Fig. 8). During periods of potential heat shutdown, rotobeating ahead of the harvester should be minimized to protect the roots from rising temperatures.

This rotobeating guideline will assist in maintaining root temperatures suitable for storage. The Agricultural staff will record temperatures and monitor trends to formulate a plan for a potential announcement of an anticipated shut down.
Frost

One of the greatest threats to successful storage is frost damage to roots before they are stored. During periods of potential frost, rotobeating ahead should be minimized, thus reducing the severity and quantity of frost damaged beets. Foliage has proven to provide a natural barrier to frost conditions, thus providing protection to the crown area just prior to and during periods of the frost. Exposed roots during a frost shutdown, experience a higher degree of frost damage, resulting in a longer shutdown period and potential storage problems. These rotobeating guidelines must be followed to provide an excellent product for storage. Years of experience have shown that roots partially damaged by frost (Fig. 9), store better if they are allowed to “heal” before being harvested and placed in storage piles. Frost damaged tissue becomes yellow to light tan and water-soaked. These symptoms are due to rupturing cells. In the event of a frost, beets will be cut at random whenever the air temperature reaches 32°F. If a significant amount of frost (Fig. 10) is present, i.e., greater than 1/4”, and/or the air temperature reaches 26°F before 5:00 a.m., stockpiling will be terminated. Stockpiling will resume when there is no longer evidence of frost damage in the beet roots.

Each factory district’s Agricultural staff has a “shutdown/startup” delivery schedule. These schedules will be dependent upon logistics and facilities of each factory district and their respective receiving stations.

Agricultural Mission Statement

Our mission is to continuously improve the Agriculture infrastructure to efficiently produce, receive, store and transport the sugarbeet crop in a manner that supports and contributes to the long range goals of the Company.