

## Joint Forum on Sugar Beet Storage

The Sugar Beet Storage Forum at the 2005 American Society of Sugar Beet Technologist was chaired by Leonard Kerb. The forum was a joint cooperation between the Agricultural and Operations sections. This was conducted to obtain perspectives of storage as influenced by Agricultural operations and the influence on Operations or processing. The joint forum gave an opportunity for all aspects of sugar production to come together and discuss the challenges and benefits of effective storage practices.

### Sugar Beet Storage Research

Darrin Haagensen from the USDA, Northern Crop Science laboratory in Fargo, ND reported on research conducted in reference to sugar beet storage. Research reported emphasized 1. postharvest respiration and root size 2. Disease (Aphanomyces, Rhizomania, and Fusarium) and postharvest storage.

Respiration is a metabolic process that degrades sucrose to provide energy and carbon compounds to maintain healthy tissue and heal wounds. The sugar beet respire until frozen. Factors that influence sugar beet respiration in storage are temperature, injury and disease. Root size or surface area may affect respiration and depends on plant population, row spacing and variety.

A research project was conducted with the objective to measure the impact of root mass and surface area on root respiration rate. They discovered respiration is greater (8.4 times that of the inner root tissue) at the root surface. The surface area is influenced by root size and root shape. Sugar Beet respiration is limited by oxygen and the greater the surface area the greater the oxygen level of a given root mass and area. Respiration rate was more closely related to root mass than surface area. The smaller the sugar beet the greater the respiration rate. However, as root mass decreases, root surface area for a given mass increases. It was also discovered that there was no relationship between respiration rate and sucrose content. Conclusion of this research was that 1. root size affects storage respiration rate (small roots): medium and large sized roots have similar respiration rates. 2. Root mass is a better indicator of respiration rate than surface area. 3. No apparent relationship between sucrose content and respiration rate. 4. There are varietal difference in root size and respiration rates. The influence of temperature and environment was significant.

Impact of root disease on post harvest storage has been an issue of concern for many years. There has been limited information on root disease severity and post harvest storage. Such information could assist growers and Agriculturist in determining wether a field should be harvested. Research conducted at the Northern Crop Science laboratory in Fargo, ND evaluated the influence of root diseases on storage of sugar beets.

### Aphanomyces

Sugar beets were separated into categories based on disease index rating establish by Dr. Carol Windels, University of Minnesota. Respiration and sugar loss was increased as root rot index increased. The longer the storage and the higher the root rot index of the

diseased sugar beets the larger the sugar loss, respiration, monetary loss and heat generation (Btu).

#### **Rhizomania**

Sugar beets were separated into susceptible, intermediate and resistant. Rhizomania influence on sugar beet respiration increased as storage length increased. Sugar loss in storage due to the presence of Rhizomania was enhanced immediately.

#### **Fusarium**

The presence of Fusarium increased respiration with resistant and susceptible sugar beet varieties. More research is needed on the influence of Fusarium on storage of sugar beets.

Continued research will include disease influence on sugar beet storability in reference to Fusarium, and Rhizomania. Soil fertility will be investigated in reference to the influence on respiration. Sugar beet respiration as influenced by sugar beet size, genotype and environment will be investigated as well.

#### **Sugar beet storage in the U.K.**

John Prince, form British Sugar presented the sugar beet storage management in the U.K.. The management practices of growers to harvest and store sugar beets was explained. Delivering clean sugar beets to the Clamps for storage prior to delivery to the processing factory was emphasized. Various techniques of reloading and sub sampling of sugar beets were presented.

#### **Amalgamated Sugar Aggressive Pile Management**

The case of managing sugar beet storage to deliver the best sugar beet for processing was presented by John Schorr, Agricultural Manager for Amalgamated Sugar. The challenges of sugar beet storage were explained as sugar beet volume, pile ground size, need for reloading to make room, weather, proper equipment, and delivering sugar beets before spoilage.

One method to address these issues is stripping of sugar beet piles. In the case of Amalgamated Sugar the program of pile stripping initially involves removing sugar beets from the sides of the piles. The goal is to remove frozen sugar beets from the pile and process these sugar beets before they thaw and decompose. Stripping of sugar beets piles using conventional methods would mean that 930,000 tons would need to be removed and processed which would take approximately 64 days. The use of a track hoe to scrape the sides of the piles to remove the frozen sugar beets reduces the tons required for removal to 372,000 or 25 days of processing. The inter-valley transfer of sugar beets and early harvest enabled the required time to strip piles to be 14 days. A track hoe would be able to remove a section of the sugar beet pile that would start 8 feet in from the edge and follow on an angle to 2 feet in at the bottom of the pile. This would remove approximately 2.87 tons per foot on a given sugar beet pile. The process of sugar beet pile stripping is initiated as soon possible during harvest and helps to cool the sugar beets by removing the dirt cone.

Removal of the sugar beets from the top of the piles is initiated approximately at christmas time or soon after. Stripping of sugar beet piles is started as soon after freezing as possible. The number of times a sugar beet pile will need to be stripped depends on size of sugar beet pile, weather conditions, time remaining until the pile is processed and condition of pile. The goal of the aggressive stripping program is to provide the factory with the best quality sugar beet possible and minimize losses.

### **Affect of pile Stripping and Storage Management on Factory Operations**

Alan Hieb, Plant manager for Amalgamated Sugar presented the processing results of the Aggressive Stripping program. The number one reason for the improved operations for recent campaigns was designated as excellent beet quality. Diffuser torque and screen pressure problems from beet quality were insignificant. Filtration problems were almost non-existent. The thick juice quality was never a concern.

One of the important indicators in determining factory performance is extraction. Extraction is the percent of sugar in the beets that is recovered as granulated sugar. Sugar beet quality delivered to the factory has a significant influence on the extraction. The apparent purity follows vary closely to extraction. Therefore, apparent purity which is an indicator of sugar beet quality can also be used as an indicator of factory performance. The raw juice has a large influence on the quality of thick juice. Sugar beet quality is the principle factor influencing raw juice purity. Quality of sugar beets dissipates over the duration of storage. With the initiation of sugar beet pile stripping, late season quality reductions have been minimized. Some of the estimated factory income losses on an annual basis *with out* the current aggressive sugar beet stripping pile management are as follows:

1. Reduced beet slice (Beet freight to Nampa): \$450,000.
2. Reduced extraction: \$372,000
3. Reduced sugar production rate: \$67,000
4. Pile sugar losses: \$122,000

**Total = 1,353,000**

The conclusion was that pile management has improved the processing efficiency of the factories tremendously. Communications between operating departments has and continues to significantly improve. Efforts in the beet storage optimization has been and continues to be vital for Amalgamated Sugar to improve efficiency and to be able to handle crop yield variations.

### **Sugar beet storage and influence on processing at Southern Minnesota Beet Sugar Cooperative**

Kelvin Thompsen presented information from Southern Minnesota Beet Sugar Cooperative (SMBSC) pertaining to management of sugar beets for storage and to enhance the quality of sugar beets for processing. The factors that affect storage at SMBSC are producing a high quality sugar beet (high sugar and purity), harvest practices, storage enhancement practices and weather. Thompsen emphasized that sugar

beet storage is not a one size fits all type of management. The practices you use this year may not work next year and they may not be successful in other areas. Delivering a "high quality" sugar beet into storage reduces losses during good and bad storage conditions.

Harvest procedures at SMBSC entail early pre-pile and regular harvest dates, diseased and other poor storage type sugar beets, harvested during pre-pile (processed immediately). SMBSC has a relatively narrow harvest window due to temperatures and precipitation (weather). Approximately 15% of the total tons are harvested during pre-pile and the remaining 85% are harvested during a period of approximately October 1-20. Harvest of sugar beets is influenced by both cold and warm temperatures. The harvest may be stopped due to temperatures of 28° F or below and sugar beet temperatures of 60° F or above. Sugar beet piles are managed to maintain a 18 foot pile height. A scalping policy for managing a quality sugar beet for storage is in place and dictates load acceptance. Scalping is a highly controversial subject within the sugar beet industry. SMBSC maintains that through scalping the highest source of impurities is removed which in turn increases purity and extractability and removes a source of regrowth and added weight which has no value.

Storage enhancement procedures at SMBSC entails early and late sugar beet deliveries removed from the sugar beet pile first. Precipitated Calcium Carbonate (PCC, Factory lime) is applied as a sunshield as soon as possible after harvest. Splitting of sugar beet pile through the middle of the pile to increase natural ventilation is initiated as early as possible. Contrary to other parts of the country which do not get the consistent cold temperatures like Minnesota experiences, the sugar beets piles at SMBSC will be completely froze during the winter storage months. Splitting the pile through the middle reduces the pile mass and increases the chance for the pile to freeze for long term storage. The smaller pile mass also increases the potential for the pile to warmup in the spring and add to the deterioration of sugar beets prior to processing. Therefore, it is essential to process split sugar beet piles prior to spring thaw.

SMBSC conducts force air ventilation on some sugar beet piles. These piles are froze to a colder temperature than naturally frozen (split) sugar beet piles. The force air ventilate piles are not split and stay froze for a longer time than the smaller masses of the split piles. The force air ventilate piles are processed last.

Snow is removed from top and sides of the sugar beet piles to assist in ventilation. Sugar beet piles are monitored through thermal scans for hot spots. SMBSC has a tentative pile splitting and re-haul to the factory. This schedule is tentative and is subject to change as it is routinely reviewed. The sugar beet you are harvesting has a large impact on harvest and storage management.