

CONSTRUCTION AND DEVELOPMENT OF FACILITY AND PROTOCOL FOR SUGARBEET STORAGE TRIAL(S)

Lee A. Hubbell^{1*}, James F. Stewart¹, David B. Wishowski², Corey J. Guza³ and Ralph Fogg³
¹Michigan Sugar Company, Agricultural Research Center, 1459 S. Valley Center Drive, Bay City, MI 48706, ²Hilleshog, 5146 Rogers Road, Akron, MI 48701 and ³Michigan Sugar Company, 2600 S. Euclid Avenue, Bay City, MI 48706

Introduction:

Michigan Sugar Company uses an evaluation of Recoverable White Sugar per Ton (RWST) after a storage period as one variety approval criteria. This criteria has been included for variety approval because of the importance of the beets preserving their sucrose content and quality for the period between harvest and processing. The approval requirement for Storage RWST was set at a lower level and only a few varieties were ever not approved for this reason. The Storage RWST requirement for approval is intended to prevent an extremely poor storing variety from being planted.

Methods:

The storage procedure we use starts by keeping a large sample of beets during harvest. By hand we clean off excess soil, remove petioles and divide the sample in two after matching pairs of beets by size. One sample is analyzed at harvest time for sucrose and quality for approval data. In the past, the second half of the beets were placed in a plastic bag and tied with a 1-½ inch PVC pipe in the opening. The beets were stored for about 120 days. The room we used previously for the storage trial used outside air to cool and was often warmer than ideal. The room was not easy to keep cool because of being inside a building and not insulated. The temperature was raised to 65-70°F two or three times during the storage period to stress the beets.

Results:

Using storage trial results in selecting varieties has been questioned by the seed companies. One concern about our protocol was the use of plastic bags to hold the beets. Bags were used to prevent the beets from dehydrating. This created unusual storage conditions. One problem caused by the beets being closed in plastic bags was that some samples juiced and were not usable. The results of some varieties were not consistent from one year to the next, Table 1. Use of plastic bags and limited control of temperature contributed to excess variation in the trial.

TABLE 1:

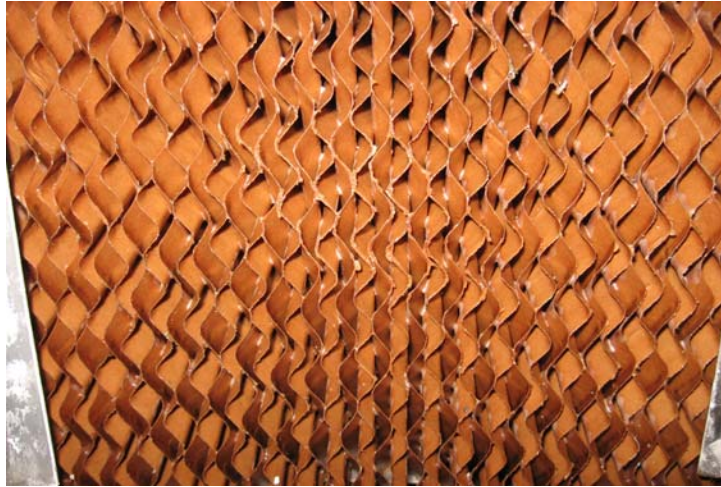
	<u>Varieties</u>		
	<u>963</u>	<u>Prompt</u>	<u>355</u>
	<u>Percent of Checks</u>		
2002	99.9	98.6	
2003	94.8	103.8	104.7
2004	98.8	98.4	102.0
2005	97.0	101.0	98.4
2006	92.5		95.2

The concerns and problems led us to build a new storage room. We visited the USDA-ARS storage facility in Fargo, North Dakota. They create high humidity conditions and plastic bags are not needed to prevent dehydration. Our new room was built inside our research center and insulated well. We worked with Techmark Inc. to create humidity over 95 percent and also cool the room. Beets will now be placed in plastic boxes and bags are not needed, Picture 1.



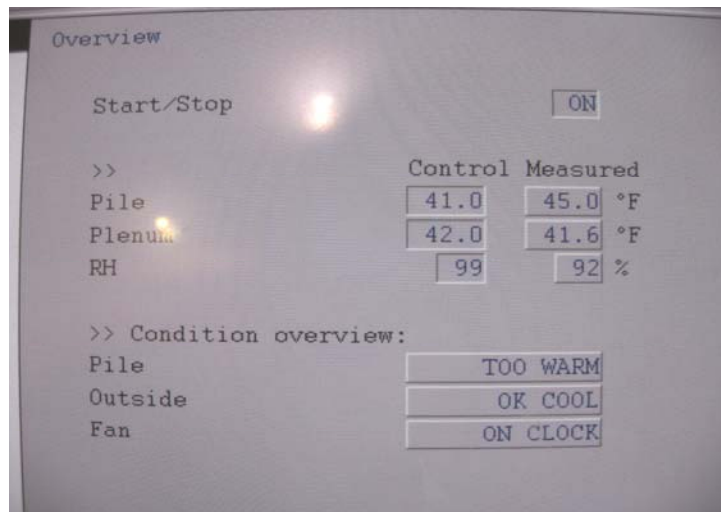
Picture 1

Tech Mark designed a system using a Humi-cell to produce humidity. Picture 2 is the material used to hold water in the Humi-cell to create humidity.



Picture 2

To cool the room, outside air is brought in and there is some additional cooling in the Humi-cell. An open area above the room acts as a plenum. To distribute the cooler, high humidity air, pipes extend down into the room near the floor between the rows of pallets every 24 inches. The humidifying system is computer controlled. Temperature and humidity are recorded from outside the building, in the plenum above the room and in the storage room. Desired temperature and humidity levels for the room and the plenum are entered into the computer, and the program controls the amount of air being brought in from outside and also the flow of water to the Humi-cell. Operation of the room can be monitored on the computer. Picture 3 shows a numeric readout of temperature and humidity. All information can be observed on graphs.



Picture 3

Picture 4 is in the room showing the air distribution pipes and boxes that hold the beets on pallets.



Picture 4

Conclusion:

After a less than perfect start, the system is now working well. The humidity was not kept as high as we need and when freezing temperatures were first brought in, the water froze on the wet material in the Humi-cell. Corrections have been made using a Humi-cell that is three times as large and a larger air mixing area before the Humi-cell to prevent freezing. After these changes, the humidity is consistently staying above 95 percent and the temperature is holding just above 40°F. To test the system, the room was opened to raise the temperature to 60°F and lower humidity. Desired humidity and temperature were restored in an acceptable amount of time.

In the new storage room, we will be adjusting our previous protocol. We will still collect the sample beets using the same method at harvest. Plastic bags will not be needed. Each beet sample will be placed in a plastic crate for stacking on pallets. The temperature program and the length of storage may be adjusted as we use the room next year.