

VARIETY STORAGE TRIALS IN MICHIGAN

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All of us in the sugarbeet industry realize how important it is for our sugarbeets to store well in long-term piles. Sugarbeet breeders have successfully developed varieties having many different traits to help growers manage risk such as aphanomyces, cercospora, late season rhizoctonia crown rot and others. Do these traits impact a variety's ability to store in long-term piles? In the early 1970's research was conducted to determine if a certain variety would not store as well as others. After observing real differences, a protocol was developed to quantify these differences. Michigan's Sugar Company's protocol to evaluate a variety's ability to store is described below (and is part of our variety approval system).

In the last harvested location (usually late October) of the Official Variety Trial small plots (two-row by approx. 30-feet) a larger (more than 25 beets) quality sample is bagged from at least four replications. Sugarbeets are removed from these large burlap bags and placed onto a working table where excess dirt or mud is removed. All the beets are crowned with a silver dollar-sized cut and long tails are clipped to not puncture bags. Beets are then evenly divided into two even piles (one for fresh and one for storage); pairing beet size by piles. Fresh beets are immediately sawed (single blade, cut length-wise) for quality analysis. This analysis is the same for all other research in determining %S (sucrose) and %CJP (clarified juice purity with "milk of lime" filtration paralleling the factory process) for RWST (120-day slide equation for recoverable white sugar per ton) plus amino-nitrogen (NH₂-N) and inverts are analyzed from this clarified juice.

The half of the sample beets for storage is placed into plastic bags (approx. 23 x 40 inches x 3 ml) with outside identification. These plastic bags are tied shut with an one-inch size opening to avoid anaerobic conditions. Samples are weighed (IN weight) and taken to the storage area. Samples are placed on the storage shelves by replication so as to have one entire replication at the same height in the storage room. Ambient (outside) air is drawn into the area to cool the beets to 40F as soon as possible and is constantly circulated in the room with fans. It may take longer to achieve 40F, if outside air is warmer. To "challenge" the variety's storability, two to four times in the 90 to 120 day storage period, the temperature is raised above 60F for seven days or less. Beets are removed from the storage area when deterioration is noted.

When the storage period is completed, these stored beets are weighed (OUT weight). Before these beets are sawed for quality analysis, a visual disease rating (0 – 5 with 0 having no rot and 5 being a completely rotten sample) is recorded. This rating scale is based on the amount of rot in the sample from very light surface rot to beets with deep rots or completely deteriorated samples. Samples are sawed and processed with the same quality analysis procedure as the fresh samples.

As previously stated, quality calculations (%S, %CJP and RWST) for fresh beets are the same as all research samples, in addition to NH₂-N and inverts being analyzed. Storage quality calculations for %CJP, NH₂-N and inverts is the same as fresh beets. Storage shrink is determined by the IN less OUT weights divided by the IN weight. This shrink value is multiplied by the %S to give the stored %S which is used in the RWST calculations. This "Storage RWST" is used in the variety approval system. Average disease ratings are also determined.

To show an example of the storage results, [Tables 1 and 2](#) list the fresh and storage values for five varieties from the 2000 Official Variety Trials. The five varieties listed show a progression over time with US H20 being the standard for storage (planted in the 1970's); HM E4 was planted beginning in the early 1980's and continues today as a specialty variety; HM E17 is the predominant variety planted (approximate 50% of the total acreage); SX Prompt was first approved for planting in 2001; and HM Exp. is a first-year experimental variety. Dramatic differences can occur between varieties.

One concern is these storage trials have more statistical variability compared to normal fresh beet analysis; values of the coefficient of variation (CV%) are twice the fresh values. The intent of this storage trial is to flag varieties which may not store well in our long-term piles. As in many things, the opportunities to improve this storage protocol exist.

Table 1: Quality values for five varieties fresh analysis from 2000.

	<u>%S</u>	<u>%CJP</u>	<u>RWST</u>	<u>NH2-N % on beet</u>	<u>Invert % on beet</u>
US H20	18.7	93.3	289.2	0.3	0.1
HM E4	19.2	93.8	299.8	0.3	0.2
HM E17	18.7	93.1	287.5	0.4	0.1
S Prompt	19.6	93.7	306.2	0.3	0.2
HM Exp.	18.5	93.7	287.2	0.3	0.1

Table 2: Quality values for five varieties coming out of storage from 2000.

	<u>%S</u>	<u>%CJP</u>	<u>RWST</u>	<u>NH2-N % on beet</u>	<u>Invert % on beet</u>	<u>Disease</u>	<u>Shrink</u>
US H20	15.9	87.7	215.3	0.5	0.6	2.6	0.973
HM E4	17.1	89.1	239.8	0.4	0.7	3.0	0.973
HM E17	16.5	88.8	229.9	0.5	0.7	2.4	0.981
S Prompt	17.4	90.2	250.3	0.4	0.5	2.4	0.974
HM Exp.	15.7	82.8	179.5	0.4	1.6	3.6	0.974