

Methods of Estimating and Expressing Quality
Losses in Sugarbeets During a Campaign

M. G. Frakes
Director Agricultural Research
Michigan Sugar Company

When considering the sugarbeet storage problem, we need to know what our losses are, where they occur and on what basis we should determine the magnitude of these losses. When calculating RWST (recoverable white sugar per ton) it is important to specify whether this calculation is based on sliced tons, purchased tons or delivered tons.

Table 1 shows the comparative RWST obtained from sliced and purchased tons during various time periods and the to-date average for a typical campaign. The to-date data is the average RWST of all tons processed to that point in the campaign. Sliced tons are equal to purchased tons, plus crown tare, plus dilution in flume water, beet washer and slicers (water up-take), minus loss in tails and small pieces. At the end of a 140-day campaign, the total of sliced tons is generally about 97% of the purchased tons or about a 3% shrink from purchased to sliced tons.

RWST, based on sliced tons to date for a campaign, shows a decline from 232 to 217, or 15 lbs per ton, during the period from 45 to 140 days of campaign. Note that the 3% shrink of sliced from purchased tons does not appear in this data. The recoverable sugar per sliced ton on a period basis drops off sharply after 90 days of campaign. There is a 54 lb difference in RWST (sliced ton) for the last 20-day period compared to the first 45-day period. Again, shrink does not show here and needs to be added algebraically.

Table 1. A comparison of sliced versus purchased tons as a basis for calculating recoverable white sugar per ton (RWST) during various periods of a typical campaign.

Date	Period Days	Total Days To Date	Recoverable white sugar per ton			
			Sliced Tons		Purchased Tons	
			To Date	Period	To Date	Period
11/15	45	45	232	232	242	242
1/1	45	90	229	224	231	220
2/1	30	120	223	205	221	191
2/20	20	140	<u>217</u>	<u>178</u>	<u>211</u>	<u>151</u>
NRST*	45-140 days		-15	-54	-34	-91

*Non recoverable sugar per ton

The RWST on a purchased ton basis for the first 45 days is about 4% higher than on a sliced ton basis because total losses in fluming and slicing (tails, pieces, etc.) do not equal the added weight received in form of crown tare and water up-take. Thus, there is a 4% over run of sliced tons from purchased tons during this 45-day period. There is no shrink involved in the purchased ton data. As the campaign progresses and beets are returned from storage piles, these losses increase. The losses increase sharply, when recovering beets from frozen piles, to a point where they are considerably greater than the weight added by water and crown tare, hence a shrink exists later in the campaign based on sliced tons.

The RWST data for purchased tons for the period of slice shown is of particular significance. This shows the actual magnitude of the non-RWST for varying periods of storage. This may be further illustrated by Table 2 which shows the RWST as per cent of gross sugar in sliced and purchased tons. Again 3% shrink is not shown in the sliced ton data. All data shown in this report is based on 15% sugar and 93 clear juice purity for purchased tons and 14% sugar in sliced tons or cosettes. It has been established that cosette sugars are about 93% of the sugar tests of beets analyzed as they are delivered.

When considered on a purchased ton basis, the percent of the gross sugar that may be recovered as white crystalline sugar goes down very rapidly after 90 days of campaign or in processing beets that have been in storage longer than 60 to 75 days.

The question, where do these losses occur, is pertinent. It is difficult to accurately determine each individual loss, but relatively easy to accurately determine groups of losses. Table 3 shows some factors contributing to increases in NRST (non-recoverable sugar per ton) after a storage period of 120 days (October 15 - February 15). This data does not represent the entire crop but only those beets sliced the last 20 days of

Table 2. A comparison of sliced versus purchased tons as a basis of showing RWST as per cent of gross sugar*. Gross sugar content is 300 lbs for purchased tons, 280 lbs for sliced tons.

Date	Days	To Date	RWST as % of Gross Sugar*			
			Sliced Tons		Purchased Tons	
			To Date	Period	To Date	Period
11/15	45	45	82.9	82.9	80.7	80.7
1/1	45	90	81.8	80.0	77.0	73.3
2/1	30	120	79.6	73.2	73.7	63.7
2/20	20	140	77.5	63.6	70.3	50.3

*Gross sugar established during the delivery period or first 45 days of campaign.

All components of the formula except S, P, and n change with length of campaign as follows:

<u>Date</u>	<u>Total Days of Campaign</u>	<u>f</u>	<u>m</u>	<u>d</u>
11/15	delivery	.97	60.0	.8
1/1	90	.94	61.0	1.2
2/1	120	.92	61.5	2.0
2/20	140	.90	62.0	2.8

By substituting the above in the basic formula, we then show the following formulae for computing RWST for a campaign from a percent sugar and clear juice purity analysis of grower deliveries.

<u>Campaign length</u>	<u>Formula</u>	<u>RWST</u> <u>S = 15 ; P = 93</u>
(1) Delivery	$(19.4S-14) (2.5 - \frac{150}{P-.8}) =$	242
(2) 90 days	$(18.8S-14) (2.56 - \frac{156}{P-1.2}) =$	231
(3) 120 days	$(18.4S-14) (2.60 - \frac{160}{P-2.0}) =$	221
(4) 140 days	$(18S-14) (2.63 - \frac{163}{P-2.8}) =$	211

These formulae will give reasonably close estimates of the RWST that will be obtained for a campaign of the lengths indicated. Factors in the formulae may be extrapolated for campaigns up to 140 days. These formulae assume reasonable storage conditions. Extremely adverse weather conditions, causing beet deterioration late in storage, would result in considerably less RWST than shown.

All data presented applies to purchased tons and to analytical results obtained with our method of handling load samples. Beets are analyzed in the same condition as received and as introduced into the factory flumes. We do not remove any crown tissue or wash beet samples used for chemical analyses. Adhering soil is removed by means of mechanical brushes.

Crown tare, on those samples used for tare, is an absolute minimum consisting only of removing the center growth bud of those crowns not cut in the harvest operation. Alternate load samples are used for testing and tare. Tare samples are not used for analyses.