A Method of Reducing Storage Loss In Siloed Beet Pulp

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The loss of solids and nutrients contained in pulp of sugar beets stored in open silos in California is of such magnitude that an investigation was undertaken to determine methods of reducing this loss.

Skirmish tests were conducted at Manteca and Woodland,[2] Calif., in which the loss of dry matter contained in untreated and impressed beet pulp stored in small trench silos, wooden barrels, and steel pipes, varied from 53 percent to 82 percent for a storage period of slightly over 200 days. The high losses obtained from these skirmish tests are in line with the experience of commercial operators of open beet-pulp silos.

Beet sugar factories, which do not dry beet pulp, pump the wet pulp to large open storage silos where the pulp is passed over screens for removal of most of the free water. The pulp as it enters the silo contains in the neighborhood of 98 percent moisture. Since cattle feeding operations in California, are generally carried on throughout the year, some pulp may be in storage for as long as 300 to 360 days.

Bacteria responsible for the formation of butyric acid cause one form of fermentation which is responsible not only for the strong and decidedly unpleasant odor of beet pulp silage but to a considerable degree also for the very heavy loss of solids and nutrients experienced when beet pulp is ensiled.

During the past 2 decades a considerable amount of research and investigational work has been carried on in Europe and in this country on the addition of preservatives to green fodders before placing in silos for fermentation and storage, but almost no work has been conducted using beet pulp.

Three methods of fodder preservation have been generally accepted as standard:

1. The A. I. V. process, developed and patented by A. 1. Virtanen of Finland. This process uses hydrochloric and sulphuric acids to bring the material to be ensiled to a pH of about 3.;1.
2. The use of molasses, either beet or cane, as the preserving agent.
3. The use of phosphoric acid, instead of hydrochloric and sulphuric acids used in the A. I. V. system.

1Spreckels Sugar Company, San Francisco, Calif.
2Unpublished data, Spreckels Sugar Company. San Francisco, Calif.

Plan of Beet Pulp Preservation Experiment

Preliminary experiments had indicated that unless some of the moisture normally in pulp as it enters the silo was removed prior to the addition of preservatives, the treatments were not effective in reducing pulp losses.

Therefore, an experiment was designed using pressed pulp (moisture content varying from 85.3 percent to 91.3 percent) with the following five treatments:

1. Pressed pulp — Xo treatment.
2. Pressed pulp mixed with *2 1/2* percent (by weight) cane molasses.
3. Pressed pulp mixed with 5 percent (by weight) cane molasses.
4. Pressed pulp mixed with 7 1/2 percent 'by weight) cane molasses.
5. Pressed pulp mixed with 2N-hydrochlorie and sulphuric acids in sufficient quantity to give a pH of 3.5.

The molasses and the acid were mixed with the pulp in a concrete mixer after which it was placed immediately in the storage bins.

There were 20 wooden, paper-lined bins, each 8 feel by 8 feet in width by 6 feet in depth. Four bins were used for each treatment ; each bin held approximately 10 tons of pressed pulp. The ouside walls of the bins were banked with earth to exclude air and minimize the effect of changes in atmospheric temperature in the storage tests.

The pulp and other ingredients were weighed and analyzed as they were placed in and removed from their respective bins, and samples of pulp were removed from each bin and analyzed at the end of each 30-day storage period.

Experimental Results

Cane molasses mixed with pressed pulp in quantities varying from 2 1/2 percent to 7 1/2 percent (by weight) and acid (2N-hydrochloric and sulphuric) mixed with pressed pulp in quantities sufficient to give a pH of 3.5 reduced substantially the amount of dry matter and total nutrients lost during a storage period in excess of 200 days as compared with losses from the storage of plain pressed beet pulp.

Pressed pulp (untreated) held in storage for slightly over 200 days lost 51.88 percent of the dry matter as compared with a loss of 32.46 percent when treated with 2 1/2 percent molasses; 18.60 percent when treated with 5 percent molasses; and 25.86 percent when treated with 71/2 percent molasses. The loss of solids, when treated with acid, was 20.41 percent.

The loss of nutrients was slightly higher than the loss of solids. Total nutrients lost from the untreated pressed beet pulp were aS.54 percent compared with a loss of 38.78 percent when treated with molasses at the rate of *21/2* percent by weight, a loss of 23.15 percent when treated with molasses at the rate of 5 percent, and 28.37 percent for a molasses treatment of 7 1/2 percent; the loss from the acid treatment was 23.38 percent.

These tests indicate that mixing pressed beet pulp with cane molasses at the rate of 5 percent molasses, by weight, or mixing pressed pulp with a mixture of hydrochloric and sulphuric acid in quantities to give a pH of 3.15 resulted in reducing the loss of dry matter in nutrients by more than one-half for a storage period of over 200 days.

Recovery of solids and nutrients from molasses-treated, acid-treated, and plain pressed beet pulp held in storage bins.

Treatment:	No treatment	2½ percent cane molasses	5 percent cane molasses	7½ percent cane molasses	.2N-hydrochloric and sulphuric acid-pH of pulp 3.5
Days in storage	228	212	216	210	205
Total dry matter:					
Introduced—pounds	294.90	254.23	300.01	300.16	297.37
Recovered—pounds	98.06	172.29	243.04	274.00	212.19
Loss—percent	51.88%	32.46%	18.60%	25.86%	20.41%
Total Nutrients:					
Introduced—pounds	151.14	193.48	239.21	282.58	190.01
Recovered—pounds	62.71	118.85	177.48	204.70	145.24
Loss—percent	58.54%	38.78%	23.15%	28.37%	23.38%
Proteins:					
Introduced—pounds	18.12	26.23	29.61	28.81	21.83
Recovered—pounds	12.26	17.90	22.33	23.44	18.93
Loss—percent.	32.29%	11.38%	5.02%	13.32%	10.80%
Carbohdrates:					
Introduced—pounds	133.63	173.25	203.62	255.78	168.69
Recovered—pounds	50.45	100.80	155.16	181.35	128.32
Loss—percent	62.11%	41.97%	25.20%	29.08%	24.06%
Crude Fiber:					
Introduced—pounds	48.11	48.43	51.83	59.79	56.24
Recovered—pounds	31.77	41.64	48.33	48.72	53.75
Loss—percent	33.97%	13.99%	6.12%	18.53%	4.38%
Ash:					
Introduced—pounds	5.60	12.33	15.97	23.90	21.18
Recovered—pounds	4.20	11.81	17.24	20.50	13.20
Loss—percent	25.73%	1.11%	(7.86%)	11.36%	37.18%

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