Commercial Pile Experiments and Improved Methods of Storage at Monitor Sugar

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The purpose of pile covering experiments at Monitor Sugar has been to develop a system that would accomplish the following:

1. Protect the outside of the beet pile from dehydration during the early part of the storage period (October-November).

2. Allow the use of a ventilation system to prevent high temperature from developing during the early storage period (October-November).

3. Prevent freezing and thawing of the sides of the piles (November-February).

4. Prevent large scale "freezing in" of the beet piles (January & February).

Four systems have been used to date with the following results:

SYSTEM I

Wooden frames 8' wide X 16' long were constructed of 2 X 3 douglas fir. These frames were covered with sisal Kraft reinforced paper. The frames were fastened to the beet piles with four 4' X 1/2" steel reinforcing rods.

The frames were first placed into use in 1965 with generally favorable results on an experimental basis.

Additional frames were constructed in 1966 and one pile of approximately 12,000 tons was covered. Also in 1966, small frames, 4' X 16', were placed at the bottom of each pile and opened during favorable weather to provide additional ventilation.

The covering reduced freezing and thawing, dehydration and had little effect on "freezing in" of the beet pile.

This system was discontinued after 1966 for the following reasons:

1. A change in manufacture of the paper between 1965-1966 caused the paper to shrink and pull off the frames.

2. The frames were difficult to remove during periods of heavy snowfall.

3. Higher labor cost for installation and lack of personnel to install and remove frames.

SYSTEM II

Nylon reinforced 32' X 100' sheets of Griffolyn type #55 plastic was fastened to the pile with 1" X 4" boards rolled in the edges and staked

down with 4' X 1/2 " steel reinforcing rods at 4' intervals. The bottom of the sheet was fastened to the ground with 1' X 4" boards and 8" reinforcing rods. The 32' wide sheet covered the side of the pile to within 4" of the top.

This system prevented freezing and thawing of the outside of the pile. It also prevented dehydration of the outside of the pile and reduced but did not prevent frost penetration on the sides.

Difficulty was encountered removing the plastic during periods of heavy snow as 10' piles of snow would accumulate at the base of the pile.

SYSTEM III

This system was first used by Mr. Fred Russell of Buckeye Sugars, Inc., Ottawa, Ohio. Six foot isosceles triangels are constructed using oak 2 X 4's. These are spaced 3 feet apart and held together with 1 X 4 oak boards (Figure 1). The outside of the frame is covered with plastic which is attached to a hinged door. This is opened during periods of cool weather to allow for some natural ventilation as well as operation of the ventilation fans. The plastic is fastened to the top of the frame and extended to the top or near top of the pile.

This system had several advantages over previous attempts at pile covering.

1. Straight pile sides are encouraged.

2. Forced air ventilation can be incorporated with the pile covering.

3. Natural ventilation can be used during the storage period if desired.

4. Removal is easier as most of the snow will slide off the plastic, if the beets are piled correctly (to the top of the frame), and accumulate at the base of the frame.

This system accomplished the first three objectives established for pile covering. The pile did freeze in from the sides during 0 F temperatures, however, this could have been reduced with a more air tight seal at the base of the pile.

The feasability of this system was partly dependent on being able to recover the plastic and reuse the wooden frames. The results from Buckeye Sugars indicated this was no problem, however, approximately 20% of the frames were severely damaged during the reloading operations. These were repaired and reused the following year (1970).

SYSTEM IV (Straw covering on the sides of the piles)

Straw was blown on the side of the pile with a modified forage harvester-blower. One ton of straw will cover approximately 1,000 tons of beets if applied 4" - 6" thick. Commercially available straw blowers are superior to the equipment used. Distribution problems resulted in straw accumulations of 12" and more.

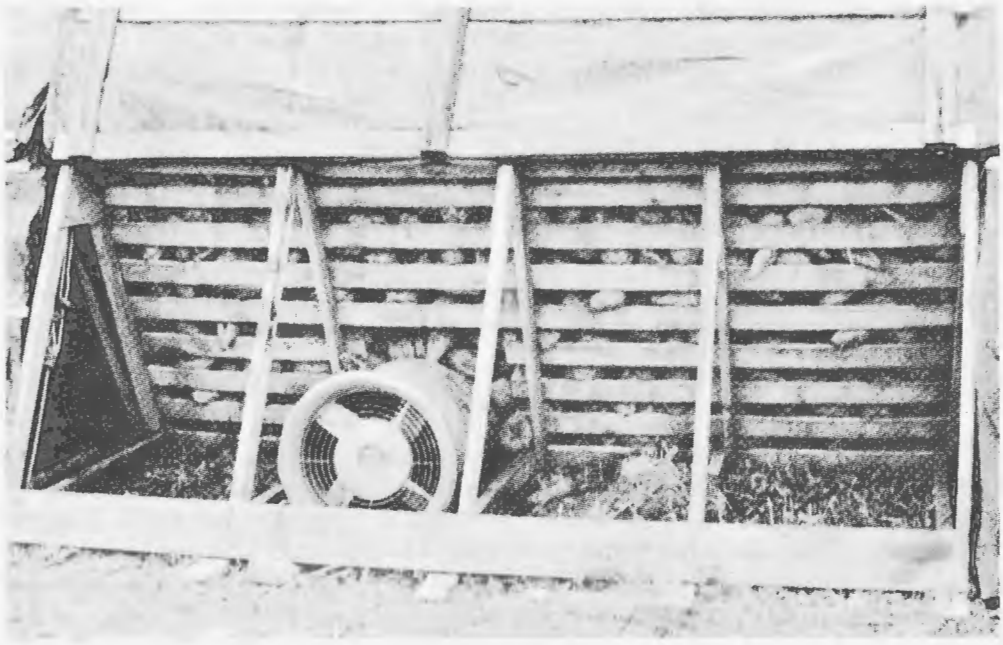

Figure 1. Isosceles triangular frame used at base of pile. Bottom cover is shown in open position.

During late December, the straw on the north side of the pile was burned off at the request of the Operations Department. The frost penetration was greater in this area when the pile was reclaimed in early February, 1971, than in uncovered areas of adjacent piles.

To summarize the results of the pile covering experiments, it should be pointed out that no covered beets were processed at the end of the campaign in any year except 1970. In some years, the beets were processed within 60 days of the date covered. During 1970, the straw covered beets which had the straw burned off one side in December were higher in raffinose in some areas of the pile than in the uncovered sections of the same pile. Large areas of frozen beets resulted in slicing difficulties.

The beets covered with frames and plastic in 1970 were in good physical condition under the plastic when reclaimed. In both the covered and uncovered piles, the interior portion of the pile was in fair to good condition. Some freezing and thawing had taken place in the interior of the pile which produced much variation in invert sugars (Figure 2) and clear juice purity (Figure 3) analysis made on diffusion juice samples.

The uncovered section shown in the two tables was the start of a pile. This should have been picked up and processed immediately after delivery.

Presently known procedures that are conducive to good storage conditions must be observed before pile covering should be attempted. These include:

1. Pile beets of cool initial temperature (50 - 55 F)

2. Avoid trash in the storage piles

3. Do not pile frozen beets

4. Effectively ventilate storage piles

5. Level tops of piles

6. Construct piles with straight sides

7. Monitor condition and temperatures of piles throughout the storage period

8. Avoid mechanical damage to beets from receiving equipment. Cooperation between operations and agricultural departments is essential to the success of any long term storage of beet piles.

Those areas which need further investigation include:

1. Systems for complete control of air flows throughout the pile during the entire storage period.

2. An accurate system for determining weight loss and changes in quality factors for evaluation of storage practices during the storage period and at the terminations of storage.

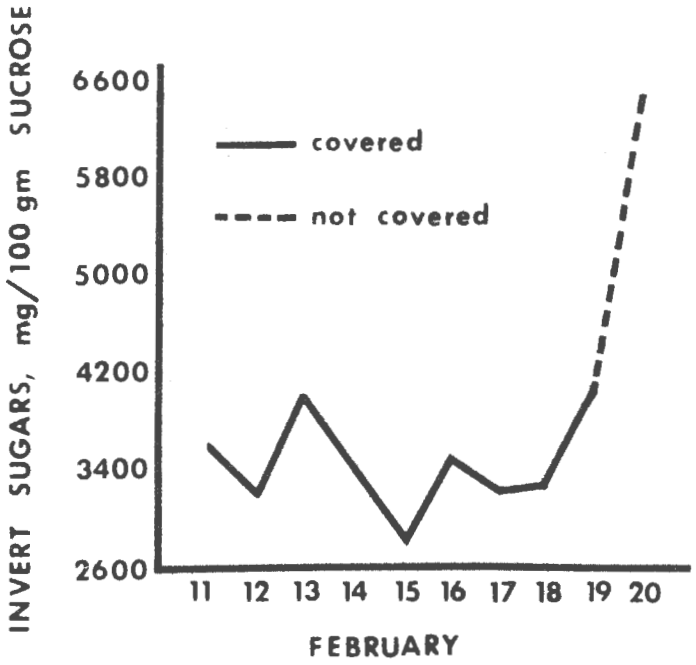

Figure 2. Invert accumulation based on analysis of diffusion juice. Covering material - Griffolyn type 55 reinforced polyethelene (1970)

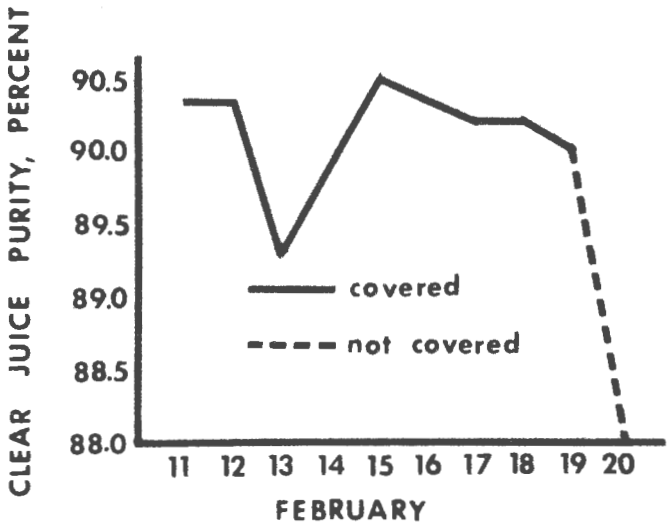

Figure 3. Variation in clear juice purity based on analysis of diffusion juice. Covering material - Griffolyn type 55 reinforced polyethelene (1970)

3. Development and modification of harvesting and receiving equipment which removes dirt and trash with a minimum amount of damage to the beets.

4. Physiological changes during storage and resulting effects on factory performance, i.e. marc degradation, sucrose transformations, etc. This will assist the agronomist and plant breeder in establishing priorities.

5. Evaluation of new systems of pile covering, pile enclosing and modified atmosphere storages from a dollar expended vs dollar returned standpoint.