

Ventilation of Storage Beets by Forced Air

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In many areas where sugar beets are grown, it is necessary to store a considerable portion of the crop. In these areas, the harvest season is often short and deliveries must frequently be completed in a five- or six-week period. Therefore, in some areas of the American Crystal Sugar Company's operations, as much as 50 percent of the total tonnage must be stored. In such instances every precaution must be taken to prevent heating, because when started this will spread rapidly, and in a short time thousands of tons can be damaged or ruined entirely.

The various conditions which cause excessive heat in the storage piles are: high temperatures during the harvest period which will cause beets to become wilted in the fields or while enroute to the factory, beets which contain an excessive amount of dirt, leaves, trash and frozen beets. All of these factors can cause excessive heat in the piles and subsequent spoilage. With the advent of the mechanical harvesters, a greater amount of leaves and trash is delivered with the beets and this has increased the danger of spoilage.

In 1947, temperatures prevailing in southern Minnesota and northern Iowa during the harvest period were exceedingly high, the beets became badly wilted during the harvest operation, and therefore went into the storage piles in a wilted condition. This shut off circulation of air through the piles and as daytime temperatures continued to be high, conditions were conducive to spoilage which spread rapidly and caused the loss of several thousand tons of beets in many beet growing areas.

Experimental Work

Prior to 1947, experiments had been carried on for several years to determine whether heating of storage beets could be lessened or eliminated by forcing cool night air through the piles and these experiments had shown a great deal of promise. The great losses incurred in 1947 accelerated this work and in 1948 the American Crystal Sugar Company started an extensive program of ventilation by this method. This program was expanded still further in 1949 at which time 140,019 tons were ventilated. This has now been adopted as a regular practice by this company, 193,000 tons being ventilated in 1950 and 214,420 in 1951.

General Procedure

The general procedure as used by this company is about the same as in all areas. Ducts are made up of used steel drums with the ends cut out, placed end to end with a 2-inch space between drums. In some instances the ducts are made up from 18 inch corrugated culvert pipe in which holes are punched on the sides and top, such holes being about 2 feet apart. These ducts are placed either crosswise or lengthwise of the pile with one end of the duct extending to the outside of the pile so fans can be inserted. When ducts are placed crosswise they are spaced from 16 to 30 feet apart, depending on the amount of ventilation desired.

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² Numbers in parentheses refer to literature cited.

Navy-type fans with two-speed motors and magnetic controllers are used, each fan having a capacity of 10,000 to 12,000 CFM. These fans are moved from duct to duct as needed. The fans are operated only when the air temperature is lower than the temperature within the piles. In some systems the fans are started and stopped by thermo-control and in other systems this is done manually.

Thermometers are placed at various points and different levels in the piles to determine where ventilation is needed. If any spot shows indication of heating several thermometers are inserted and, if the temperature cannot be brought down by ventilation, this section is removed and sliced immediately.

Results Obtained

Much data has been accumulated during the several years that this system has been in operation, much of which was recorded in the 1948 and 1950 Proceedings of the Society.

Table 1.—Comparison of Sugar Losses in Ventilation and Non-Ventilation Piles—From Data Collected in 1946, 1947, 1948 and 1949 By American Crystal Sugar Company.

Year	Location	Loss in lbs. of sugar per ton per day			
		Ventilated	Days in Storage	Non-Ventilated	Days in Storage
1946	Clarksburg (1)	.94	35.0	1.55	15.0
1947	Rocky Ford (2)	.122	40.0	1.505	40.0
1948	Clarksburg (3)	.75	50.1	1.12	25.3
1949	Clarksburg (3)	1.15	27.0	1.55	32.1
1948	Mason City	.575	26.3	1.06	17.0

In every instance this data shows that sugar losses are greater in the non-ventilated piles than in ventilated piles. Observations have also shown that there is much less heating in the ventilated piles than in non-ventilated piles; therefore there is less spoilage

Conclusions

Through several years of extensive experimental work as well as large scale operations, the following conclusions have been arrived at (1), (2), (3) :•

Sugar losses are reduced by ventilation.

Spoilage of storage beets can be greatly reduced, if not entirely eliminated by ventilation if done at the right time.

The best results are obtained if the temperature of the pile can be brought down to 60 degrees or less as soon as possible after piling. This is especially true if daytime temperatures at the time of piling are high.

When daytime temperatures are 60 degrees or lower at the time of piling there is very little need for ventilation.

From records kept in one district in 1950, the operating costs of labor and material on 31,520 tons ventilated was .0292 cents per ton. This did not include the original cost of fans, ducts, wiring and permanent equipment.

Ventilation by this method will not entirely eliminate heating and spoilage of storage beets but if the beets are reasonably free from leaves and trash and in fair physical condition, experience has proven that there is very little danger of spoilage.

From our experience, controlled ventilation of storage beets by forced air has proven to be economically sound and the best method developed to date to reduce the spoilage in storage beets.

Literature Cited

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