

1947 Results of Beet Storage Pile Ventilation

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FORCED VENTILATION of a 2,500-ton pile of sugar beets with cool night air made it possible to store beets for a period of 35 days at Clarksburg, California, in 1946. During the 35-day storage period there was a loss of 0.94 pound of sugar per day per ton of beets stored, while a loss of 1.55 pounds of sugar per day per ton stored was incurred on a non-ventilated beet pile, in spite of the fact the beets were stored for only a 15-day period.

To further determine the possibility of moderately long periods of beet storage in the Clarksburg area, an experiment similar to the one run in 1946 was made in 1947. As in 1946, the regular non-vented factory pile was used as a check for the 1947 experiment.

Experimental Procedure

Ventilator ducts were constructed using 2 by 12's for the sides, and with pieces of 2 by 12 by 18 inches spaced 1 inch apart on top. Several 2 by 6 by 18-inch pieces were nailed on the bottom to prevent collapsing. The 2 by 12 by 16-inch pieces on the first 10 feet of each 60-foot duct were placed tightly together to prevent the escape of air before it had reached some distance into the pile. Each 60-foot duct was placed 12 feet apart and they were arranged so that alternate vents would be exposed on each side of the pile for a distance of about 5 feet. The opposite ends of the vents (in the pile) were blanked off. Since the pile was 60 feet wide, these dead ends were approximately 8 to 10 feet of the opposite side of the pile. A total of fifteen 60-foot ducts were placed crosswise under a beet pile of 2,675.59 tons. This experimental pile was approximately 190 feet long, 67 feet wide at the bottom, 23 feet wide on top and 16 feet high.

Three fans were used for blowing air. Two of the fans were of the low-velocity type, each with a capacity of 2,000 cubic feet per minute, while the third was a high-velocity fan with a 1,500 cubic feet per minute capacity. The fans were coupled to the ducts with a heavy canvas tube making it fairly simple to move each fan from one duct to another.

To obtain the temperatures in the pile, a total of 23 thermocouples were installed under the direction of Coby Lorenzen of the University of California at Davis. The thermocouples were placed at levels 4 feet above the ground (12 thermocouples), at eight feet above the ground (8 thermocouples), and at 12 feet above the ground (3 thermocouples). Since the number of thermocouples was limited, all 23 of them were located in only about one-half the length of the ventilated pile.

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Temperature readings were obtained on the average of six times per day, or approximately every 4 hours for the period of the experiment.

Experimental Results

Piling was started October 20 and completed October 25. Only machine-topped beets went into the experimental pile. After the experimental pile was completed, piling of beets in the non-vented regular pile was begun, and continued until November 20. The weather during the storage period of 1947 was, in general, more favorable for beet storage than conditions experienced during the 1946 season. There were a preponderance of days with cool north winds, and this made it possible to open up the vents on the north side and allow for natural wind ventilation. It also made it possible to use the fans on the south side of the pile during the periods when north winds were blowing. As a result the fans could be used over the entire area of the pile in only half the time required if north winds had not been blowing. The three fans were run from approximately 7:30 p.m. to 7:00 a.m. every night, depending on outside temperature on three of the fifteen ducts during the storage period.

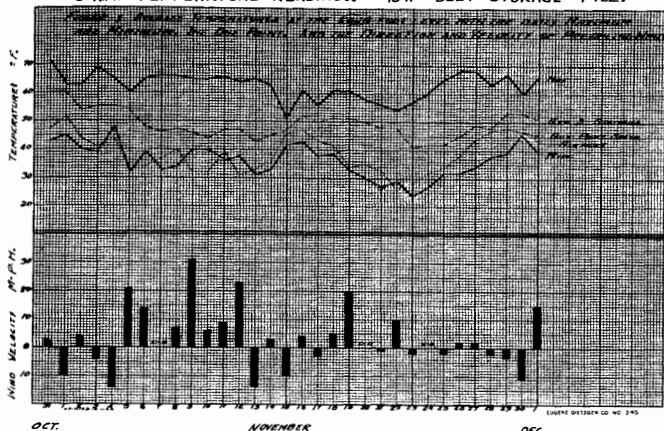
To be sure that adequate ventilation was taking place in the pile, smoke was blown through the vents three times during the latter part of the storage period. Since smoke was observed on the opposite side of the pile in about 15 seconds, and through the top of the pile to a width of 40 feet in 2 minutes, it was obvious that good air circulation was being obtained from the fans.

As may be noted from figure 1, the average temperature of the pile was 60 degrees Fahrenheit for the first 2 days of the storage period. The lowest average temperature of the pile was 41 degrees Fahrenheit, and was obtained November 23. From this date on, there was a gradual rise in average temperature until December 1 when the average temperature was 51 degrees Fahrenheit, at which time the experiment was concluded.

Figure 2 gives the average temperatures for the 4-, 8-, and 12-foot levels. Until November 17 the temperatures at the various levels were as normally expected, with the 4-foot level being the lowest, and the temperatures of the 8-foot level falling between the 4- and 12-foot levels.

On November 17 there was a slight drop in temperatures at the 4- and 8-foot levels, and a very marked drop in temperature at the 12-foot level, with the result that the 12-foot level was several degrees cooler than the lower two levels of the pile. Exactly what factors were responsible for this phenomenon are not known except that there was a total of 0.65 inch of precipitation November 15 to 16 with fairly low temperatures during the day November 17. Since the drop in temperature was much more pronounced at the 12-foot level there is the strong likelihood that the temperature of the pile at this level was affected by the cooling effect of the rain and also from the evaporation that took place.

8-AM. TEMPERATURE READINGS, 1947 BEET STORAGE PILE.



Processing of the beets in the experimental pile was started November 29. For the most part, the beets were in a fairly crisp condition. There was only one spot where any amount of decay was found. This was due to a pile of trash which had completely decayed, destroying a small area of beets in the immediate vicinity. Undoubtedly this would have been a very large hot spot, except for the fact that the trash was located directly over a vent.

Of a total of 2,675.59 tons of beets which went into the experimental pile, 2,470.18 tons were recovered. This represents a shrinkage in weight of 7.67 percent. The average sugar of the beets into, and out of storage, was 15.80 percent. Calculated on a tonnage basis this shrink represents a loss of 0.59 pound of sugar per ton per day for the 41-day storage period.

In the non-vented factory pile, beets were stored for an average of 17 days, and in this pile there was a loss of 0.73 pound of sugar per ton per day of storage.

Conclusions

The results obtained from the experiments in 1946 and 1947 at Clarksburg, California, indicate that ventilated piles may be stored from late October to early December, for a period of 40 to 45 days, without too great a risk. Where piles are non-vented, severe loss may occur if the storage period is over 15 days, during the same season. With larger capacity fans it may be possible to still further cut sugar losses and probably lengthen the storage period in vented piles.

The main external factors which appear to affect the temperature of the beet pile are the cool north winds and the mean daily temperatures.

Experience in the piling of beets strongly favor piling only freshly topped beets. Under California conditions this requires the piling of only machine-topped beets which are only a couple of hours out of the field.

B-A-M. TEMPERATURE READING. 1947 EXPERIMENTAL BEET STORAGE PILE.

