Beet Shed Ventilation in California

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Short-time ventilation of beets in storage bins is relatively new (1, 2)[2]. Usual practice in California is to coordinate harvest and factory operation so closely that beets remain in the sheds or bins only 10 to 48 hours. Air temperatures are often so high, however, that losses of commercial significance can occur even in these short periods of storage. The present paper is concerned with permanent ventilation installations at Tracy and Carlton, California.

Description of Equipment

The beet receiving sheds at the Carlton and Tracy plants in California are both of the same size and construction, and the ventilation installations are basically the same, with a few minor improvements being used at Tracy. The installation at Carlton ventilates half of the sheds, or about 2,000 tons of beets, while the one at Tracy, which is twice as big, ventilates the complete shed, or approximately 4,000 tons. At Carlton two 30-inch diameter main ducts are used with a 7.5-h.p. axial flow fan on both ends of each duct (1). The two ducts are in line and each runs half the length of the bin. There are seven lateral ducts on both sides of each main duct which carry the air to screened openings in the floor of the bin. These lateral ducts are spaced on 16-foot centers and each one is equipped with a damper for control of the air. The main ducts at Carlton are equipped with a spray chamber next to each fan. By saturating the air with moisture in a spray chamber the dry bulb temperature was lowered to the wet bulb temperature, a decrease of as much as 35° F. Since the temperatures encountered at Tracy are considerably lower than Carlton, the spray chambers were omitted in that installation.

In operation, the fans are turned on as soon as any beets are placed in the bins, and are left on until all the beets have been removed. The dampers are all closed when the flumes are empty, and they are opened individually as the beets cover the screened openings. When the beets are flumed out of the bins, the dampers are again closed as each opening is uncovered. Thus, maximum use of the available air supply is obtained. Under full load, when the bins are completely filled, the air supply is 27 cfm per ton of beets, and increases as the amount of beets in the bin decreases.

At Carlton, a man has to crawl underneath the bin to operate the sliding dampers. This procedure is rather bothersome, especially when the labor supply is short, so at Tracy pivoted dampers are used, and they are lever-operated from within the bin by the Burners. At Carlton a flat screen was used to cover the duct openings in the bin floor. These screens allowed a considerable amount of dirt to fall through them and into the duct so that the duct needs to be cleaned frequently. The openings at Tracy were covered with a bar grid, or louvre, which prevented the dirt from entering the duct.

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[2] Figures in parentheses refer to literature cited.

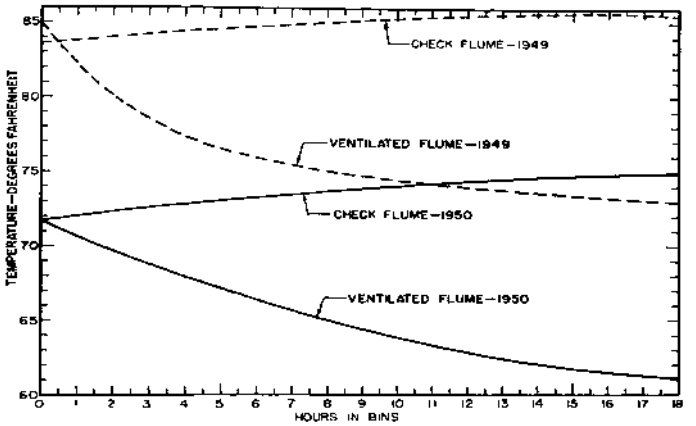

Figure 1. Average beet temperatures.

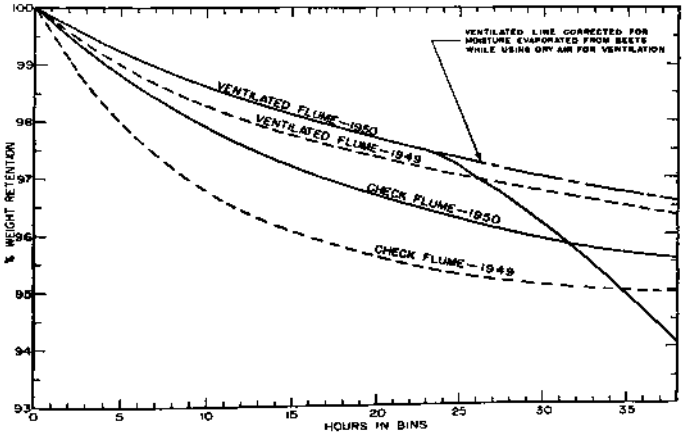

Figure 2. Weight retention curves.

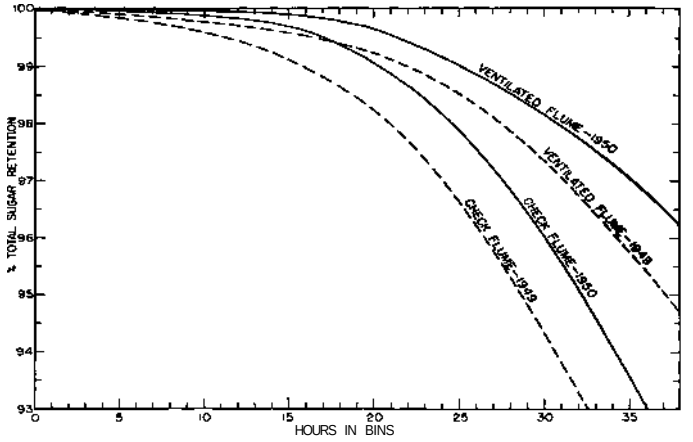

Figure 3. **Total** sugar curves.

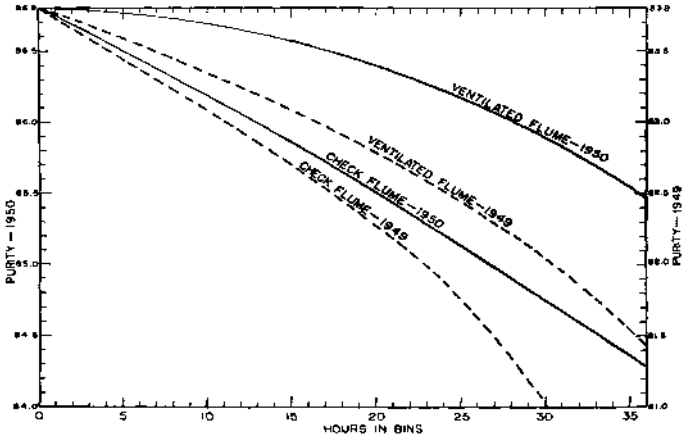

Figure 4 . Purity curves.

Results

A small scale experiment was conducted at Carlton in 1949, and the results of this experiment have been published (2). The commercial size equipment was installed at Carlton for the 1950 campaign, and three tests were conducted that year to evaluate it.

In each test 20 matched triplicate samples, as described elsewhere (2) were used to determine losses in the beets while being held for processing. It was not possible to remove ventilated and non-ventilated beets simultaneously and, therefore, statistical analysis was not practical. The magnitude and consistency of the data, however, gave us confidence in the over-all results. Curves were plotted for temperatures, weight retentions, total sugar retention and purities. These curves, as well as the curves for the 1949 tests, are shown in Figures 1, 2, 3, and 4. It can be noted that although temperature reductions were of the same magnitude for both years, differences in weight and total sugar retention were smaller in 1950 than in 1949. This is to be expected, as temperatures were lower when the tests were conducted during the second week of June, 1950, than during the first half of July, 1949.

The results for 1950 closely parallel those of 1949, with the savings for 1950 being approximately 60 percent of those obtained in the 1949 tests. The results obtained in 1950 should be closer to an average for the entire campaign with less savings obtained in May and greater savings during the hotter month of July.

The average retention time for beets in the bins at Carlton is 15 to 20 hours. Figure 1 shows that the temperature at the end of 15 hours was 75° F. for the check flume, while the ventilated flume was 13.5 degrees cooler, or 61.5° F. Figure 2 shows that beets in the ventilated flume lost 1.8 percent of their original weight in 15 hours, while the check flume lost 2.7 percent. The total sugar loss at the end of 15 hours was 0.1 percent for the ventilated flume and 0.25 percent for the check flume, or 2.5 times as great as the loss in ventilated beets (See Figure 3). Figure 4 shows .7 percent greater drop in purity for the check flume in 15 hours than for the ventilated one.

With an 80-day campaign at Carlton and 2,000 tons of 18 percent sugar content beets being ventilated for 15 hours every other day, the saving in actual Sugar would be 43,200 pounds per campaign. Combine this actual saving in sugar with the higher extraction possible with higher purity from ventilated beets, and the ventilation installation will easily pay for itself in two years of operation.

The equipment for ventilation at Tracy was installed for the 1951 campaign, but no tests have been conducted there as yet.

Literature Cited

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1951. "Beet Sugar Technology," P. 117, New York, Reinhold Publishing Corporation.

(2) ORLEANS, L. P. and COTTON, R. H.
1950. "Commercial Ventilation of Beets in Storage," Proc. Amer. Soc. Sugar Beet Technol., Sixth Gen. Meet., p. 637.