

SUGAR BEET TOPS HELP INSULATE ROOTS FROM HEAT IN THE DAYTIME AND NIGHTTIME FREEZING TEMPERATURES

Greg A. Dean* and Clark W. Millard

The Amalgamated Sugar Company LLC, P. O. Box 8787, Nampa, ID 83653

Introduction:

Between 180,000 and 200,000 acres of sugar beets (*beta vulgaris L*) are grown in Idaho, Oregon, and Washington. In the fall, just before sugar beets are harvested, but after defoliation, the sugar beet roots can be exposed to extreme temperatures when sugar beets are defoliated too far ahead of the harvester. This practice, routinely done for grower convenience, has a negative effect on sugar beet roots. From September 10 to October 15, ambient air temperatures can reach highs of 85°, and from October 15 to November 15, ambient air temperatures can reach lows of 0°. Extreme ambient air temperatures have a negative effect on sugar beet root quality and sugar beet root storability

Objective:

We conducted a study to determine whether sugar beet tops insulate sugar beet roots from daytime high ambient air temperatures and nighttime low ambient air temperatures.

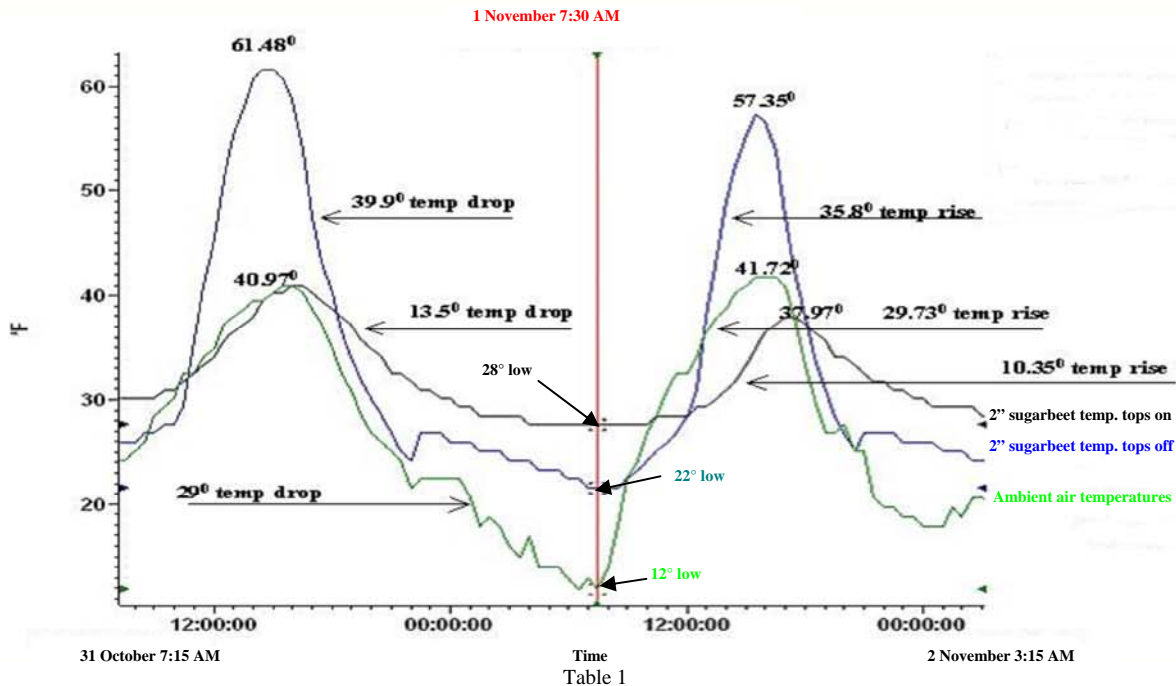
Materials and Methods:

During the fall of 2003, at Reverse receiving station near Mountain Home, Idaho, we monitored temperatures using Hobo® temperature data loggers. We measured ambient air temperature, as well as temperatures in sugar beets 2" centered below the last leaf scar, both in beets whose tops had been removed and beets whose tops remained intact. We selected an area in a commercial sugar beet field, where top growth and stand were uniform. The plot size was 44" by 60" (2 rows by 5'). One plot was defoliated using a shovel; in the other plot the beet tops were left intact. (See picture 1.) Temperature probes in both topped and untopped sugar beets were inserted 2" below the last leaf scar by boring a 1/4" diameter hole into the sugar beet. This allowed the thermocouple to rest approximately in the center of the sugar beet. After the temperature probes were inserted, the holes were sealed using silicone. The Hobo® data loggers were programmed to capture temperatures every 15 minutes, 24 hours a day, beginning October 10 and ending November 20, 2003.

Results and Discussion:

We noted significant differences in temperature when sugar beet tops were left on. Table 1 shows 44 hours of the total data collected. Within the data shown in the graph, the total 24-hour ambient air temperature movement (high temperature to low and low to high, rounded up) was 60°. The sugar beets with intact tops registered a movement of only 24°, the least movement of all monitored locations. The corresponding

temperature of the 2" sugar beets without tops was 75°, a 15° increase over ambient air temperatures, and a 51° increase over the 2" sugar beets with intact tops. We assume that sugar beets without tops measured higher in temperature than ambient air temperatures was because the sugar beets without tops captured additional heat from direct sunlight. Sugar beets with intact tops were insulated from ambient heat and cold. We also found that they were shielded from the effects of direct sunlight (radiant heat).



It is apparent from this study that leaving sugar beet tops on as long as possible before harvesting will reduce extreme temperature changes in sugar beet roots, thus effectively slowing respiration rates and minimizing sugar loss. Sugar beets whose tops are left intact until just before harvesting will result in improved sugar beet respiration rates, quality, and storability. Both sugar beet growers and companies can benefit from this knowledge. For optimal results, sugar beet growers should not defoliate sugar beets more than 30 minutes, or one round, ahead of the sugar beet harvester.

The main reason sugar beet growers defoliate more than 30 minutes or one round ahead is that the sugar beet harvester can dig sugar beets faster than the defoliator can remove the beet tops. Sugar beet growers regularly defoliate as much as a day ahead so as not to slow the harvester. Sugar beet respiration rates, quality, and storability are compromised when this occurs. The typical solution is for growers to slow down the harvester or speed up the defoliator or defoliate ahead. However, there is another solution. Sugar beet growers can utilize a shredder ahead of the defoliator. Steel-flailed shredders can do most of the work that defoliators have done in the past, leaving only 2-3" of petiole on the sugar beet. Because the workload is much reduced, the defoliator tractor is able to go much faster; it also uses far less fuel, flails last nearly twice as long, and growers are able to stay 30 minutes or one round ahead of the harvester. When the defoliator stays close to the harvester, both the quality and storability of sugar beets delivered are much improved.