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Silage Temperatures: How Hot is Too Hot?

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The production of heat is a normal occurrence during silage fermentation. If silage is well packed and sealed immediately, the average temperature of the mass should not rise to more than 10 to 20 °F above the ambient temperature at filling. However, it is common to measure temperatures as high as 110-130 °F in the upper most layers of silages during silo filling. These high temperatures are a result of excessive amounts of air trapped in the top layers of forage. The key is that these temperatures should decrease quickly as further packing removes air from the mass. Prolonged high temperatures above 115-120 °F can lead to heat damaged protein. Temperatures in this range can also be detrimental to many lactic acid bacteria that are needed to achieve a successful fermentation. Thus, chop forage adequately, pack quickly and tightly and seal as soon as possible to keep the air out of the forage mass.

When the active phase of fermentation is complete, temperatures in the core of the silo often fall to 70 to 85 °F . However, a second wave of heat can be produced in silos because of aerobic deterioration. Penetration of air into the silage mass allows spoilage yeasts to metabolize lactic acid. As a result of this, the mass reheats and silage pH increases. Molds and opportunistic bacteria that thrive on oxygen cause more heating and spoilage. In some cases we have measured temperatures in silage faces in excess of 145 °F. Signs that silage is aerobically spoiling include measuring temperatures in excess of 100 °F four to eight inches in back of the silo face at feed out, reheating in the bunk, visible mold, lack of a sharp or sweet smell to the silage and/or a flat or moldy/musty smell. If a pH meter is available, a moldy smell coupled with a high pH may also be a good indicator that a feed has undergone aerobic deterioration. Aerobic deterioration of silages is of course more common during warmer weather.

During cool weather, steam is often released during feedout from the face of large silos because of the difference between retained heat and the ambient temperature. The presence of steam does not always mean that silage is spoiling. In fact, large silos can retain significant amounts of heat for prolonged periods of time. Figure 1 shows the core temperature of a large bunker silo of corn silage in Wisconsin measured from a temperature logger that was buried at the time of ensiling. The silo was filled on Aug 18 and the data logger was retrieved on Dec 23. The temperature rose to a high of 98 °F and slowly declined thereafter. The core temperature remained above 90 °F for more than 3 months although ambient temperatures were in the 40-50 °F in December. Retained heat

should seldom register above 95 °F especially after 2 to three months of storage. Relatively inexpensive probes can be used to monitor temperatures in silage piles. Purchase one that is at least a 2 -3 ft long.

Figure 1. Core temperature in a bunker silo.

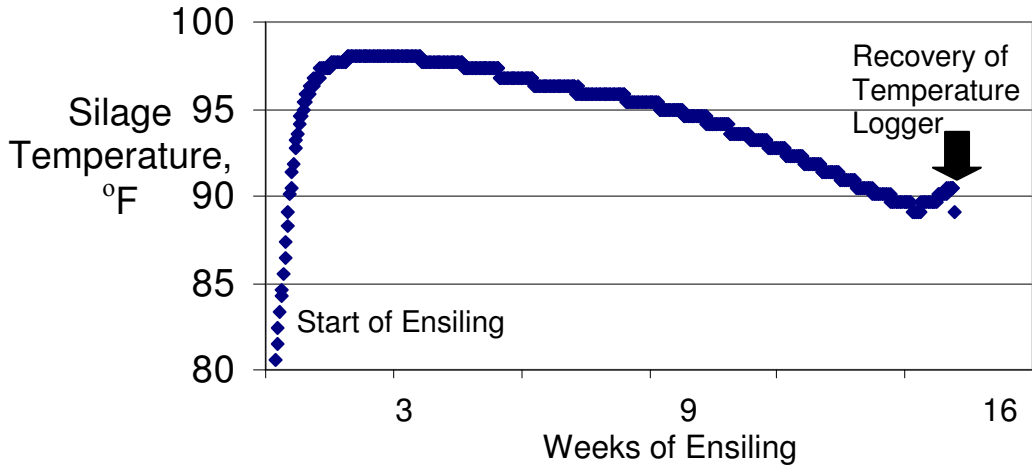


Table 1. Average normal temperatures of silage.

Stage	Normal Temperature Range
Early ensiling, core temperatures	85 to 105°F
Early ensiling, shallow surfaces, loosely packed	85 to 130°F
During storage - large silos, deep core temperatures	70 to 95°F
Active, aerobically spoiling silages	>110-120°F