## **Power-Packing Silage**

by Dan Undersander, University of Wisconsin

Good silage density, whether in a tube or a bunker, is important in the reduction of oxygen content in the ensiled material so that respiratory losses and microbial growth are reduced, which cause breakdown of nonfibrous carbohydrates to carbon dioxide. Since nonfibrous carbohydrates are 98% digestible, each 1% dry matter loss is essentially 1% loss of total digestive nutrients (TDN). Increasing silage density from 10 lbs dry matter/ft<sup>3</sup> to 16 lbs/ ft<sup>3</sup> can reduce dry matter losses by 5%. The recommended silage density for either tubes or bunkers is a minimum of 14 lbs DM/ ft3. Greater densities will reduce dry matter loss even more but are difficult and expensive to achieve. (See Figure 1.)

What factors can we manage to increase silage density? Brian Holmes and Rich Muck developed a spreadsheet that will evaluate factors affecting silage density and predict what the density will be in a bunker based on management. The spreadsheet is available online at: http://www.uwex.edu/ces/crops/uwforage/BunkerDensityCalc2-28-06.xls.

The major factors affecting packing density are silo height, silage delivery rate, silage dry matter content, particle size, packing layer thickness, packing tractor(s) and the percent of filling time the packing tractor is in operation. Silo wall height and silage height are largely decided when the bunker is built and typically undergo minimal changes between fillings. However, all other factors are controlled by the operator making the silage and may have large effects on silage losses and silage quality.

A chopped silage particle size (theoretical length of cut) of 3/8 inch length with 15-20% more than 1.5 inches is recommended, except for corn silage which can be chopped longer when processed. Chopping shorter particle sizes takes more fuel for minimal increases in packing and longer particles sizes do not pack as well.

Silage moisture content negatively affects packing density (i.e., 65% moisture silage will have less packing density than 60% moisture silage if all other conditions are the same). Therefore, wetter silage must be packed in thinner layers or packed longer to get the same density as dryer silage.

Packing requires skill and should be assigned to an accomplished operator. The recommendation for silage packing is that silage should be packed in layers 6 inches thick or less. For example, with 50 tons as fed/hour silage delivered to the silo and 35% dry matter, packing with a 30,000 lb tractor will result in a silage density of 14.3 tons DM/ft<sup>3</sup>. If the silage layer thickness is 8 inches, the silage density with the same conditions will be 12.7 tons DM/ft<sup>3</sup>. Four inch layers will result in 17.4 tons DM/ft<sup>3</sup>. Thus, layer thickness when packing can greatly affect silage density and result in silage losses.

Studies with different operators filling silage tubes with the same machines have shown differences in silage density. This again stresses the need for trained operators filling the silo.

Always pack bunkers with a heavy tractor, adding weights whenever possible. In addition to the packing tractor size, the percent of operating time can be significant (see Figure 2). In most situations, packing tractors should run as continusously as possible. In the above example, reducing the packing time with a 30,000 lb tractor from 100% to 60% of fill time would in turn reduce the packing density to 1.5 lbs/ft<sup>3</sup> and increase silage loss about 3%.





Download the silage density spreadsheet (available online at: http://www.uwex.edu/ces/crops/uwforage/ BunkerDensityCalc2-28-06.xls) to determine the expected packing density for certain conditions. Small management changes can also increase the packing density above 14 lb DM/ft<sup>3</sup> and save 5-7% dry matter and TDN of silage.

