Monsanto Dairy Silage Bunker Surveys and Study

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Silage bunker density is one of the most important silage management items to consider when producing high quality feed. Among other things, density can be affected by chop length, harvest moisture, packing weight, fill rate, and removal. Density directly impacts dry matter loss or shrink. Dry matter losses from improper packing have been as high as 30%. The impact from improper packing may also impact the quality of feed and allows oxygen to enter the silo resulting in poor fermentation. Silo management and the importance of proper packing is not a new concept, however, they continue to be the most overlooked during silo filling. One of the most commonly presented density-to-dry matter loss tables involves research conducted by Ruppel (1992, see table). The study focused on bunker silo dry matter loss with alfalfa silage after 180 days of storage. Increasing density from 10 to 22 lbs DM/ft^3 resulted in a 20.2% to 10% DM loss, respectively.

Density (lbs DM/ft$^{3)}$	DM Loss 180 Days (%)
10	20.2
14	16.8
15	15.9
16	15.1
18	13.4
22	10.0

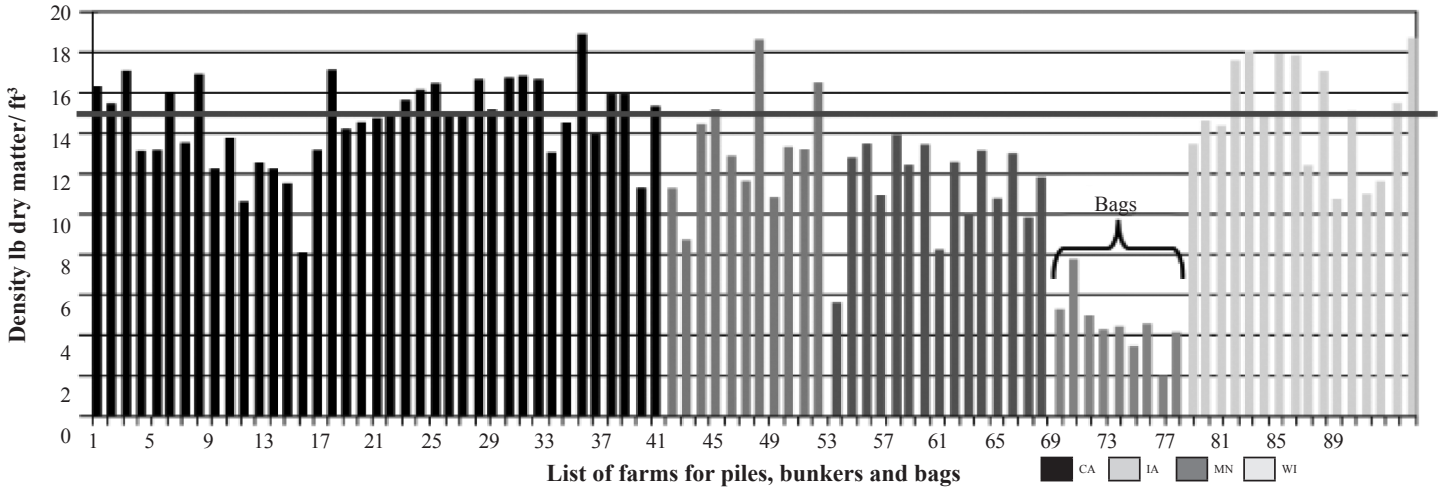
What do the numbers really mean? Example: Start with a 2,000 ton bunker with 20% DM loss. Utilizing proper packing, the DM loss is reduced to 13% saving 140 tons of corn silage/year. Savings equate to $4,900/year (using $35/ton for corn silage) by changing the packing density from 10 lbs DM/ft^3 to 18 lbs DM/ft^3. Another factor not considered in the cost is the DMI reduction leading to a milk production decrease due to potential spoilage organisms in corn silage.

Beginning in 2005 and continuing in 2006, Monsanto Dairy conducted a survey of 90 dairies in California, Iowa, Minnesota and Wisconsin to determine the percentage of corn silage densities at or above the targeted minimum density of 15 lbs DM/ft^3. Nine of those sampled included corn silage stored inbags, with the remaining utilizing bunkers and piles. Over both years, 480 samples were collected from the four states (see figure).

Although referenced on the figure, bag samples were not included in the overall targeted density calculations. Only 37% of the remaining 81 dairies sampled were at or above the target minimum density of 15 lbs DM/ft^3. Monsanto followed up with the 51 dairies with lower packing densities, offering management advice and budget analyses to determine if additional packing equipment would be beneficial. Some of these dairies added additional tractors the following year and spent more time during the filling process, increasing the densities to the minimum target level and, in some cases, exceeding the minimum level. Recommendations: use appropriate filling rate, have adequate tractor weight to properly pack material, keep layers thin and harvest at optimum moisture level. By following these recommendations, a 15 lbs DM/ft^3 density or greater is achievable. Considering today's chopper capacities, adding an additional tractor during the packing process is highly recommended. To calculate if the additional tractor would pay for itself, visit: http://www.highplainsdairy.org/2006/Hinen.pdf and download the original 2005 Midwest survey highlights.

Based on 2005 survey results, Monsanto Dairy evaluated additional questions regarding corn silage bunkers/management including:

What effects do differences in corn silage density have on dry matter loss? Standard dry matter loss calculations used today are based on alfalfa silage work conducted by Ruppel.



How are temperatures determined during ensiling and removal at different densities and different management levels of removal? Previous research utilized probing techniques to measure the temperature during various stages of feedout.

What are the effects of time in a bunker on digestibility of fiber and availability of starch? European research has demonstrated longer silage storage results in increased starch availability, increased fiber digestibility and an increase in protein solubility.
How long should silage be stored before feedout occurs and what are the economics of longer term storage? European research implies corn silage will get better with time, but can dairies afford to store the silage long term?

As a result of these questions and their potential answers, Monsanto Dairy began a bunker silo study during the 2006 harvest season including seven dairies located in California, Idaho, Iowa, Minnesota and Wisconsin. The study looks at differences in dry matter disappearance, fermentation temperatures and fermentation profiles at different packing densities. Changes in corn silage starch availability and fiber digestibility over time, and resulting economics around carrying larger inventories in order to capture possible improvements in silage feeding quality will also be evaluated. One lot of silage was collected for each location and placed in 36 Dacron® bags which were placed in each bunker trial site in four lines of nine bags. The nine samples were arranged across the bunker at three depth levels. The lines were spaced to have a set of bags recovered every two-three months. Each line contained three bags with time/temperature recording devices monitoring temperature during the storage period. The Thermochron® iButton temperature devices are programmed to record the time/temperature every four hours. The storage capacity of each device allows the capture of time/temperature up to 12 months. The size of the device does not compromise the sample bag because it is no larger than five dimes stacked together. Each bag location was noted and a plastic streamer attached for safe retrieval. The area around the bag is sampled during feedout for density measurements. In addition to the Dacron® bags, mini silos from the same lot of silage were created using vacuum sealed bags replicating short and long term effects of storage. After recovery, the Dacron® sample bags are placed in plastic bags and immediately frozen until they are shipped into the forage laboratory for storage prior to mass analysis.

Currently, one site has had all bags recovered, five have one to two lines recovered, and one site is waiting for its first bags to come out. Starch and fiber digestability analyses from all site samples will occur in the same laboratory run. As a result, there is no data to present at this time. Monsanto is partnering with Dairyland Laboratories to have the material analyzed. The study itself has generated interest in the dairy industry and final results are eagerly awaited. Please check future MFA's Clippings and nutrition conferences for the final data release. If you have hybrid, trait or harvest management questions please contact your local Monsanto dairy representative.