High quality corn silage does not just “happen”, it is planned. As with any process, there are control points where an incorrect decision can reduce the quality and value of the final product. Conversely, correct decisions can help retain feed quality and aid in making more milk. Understanding and using these control points is what separates the best managers from the rest. Therefore, these control points are worth a closer look.

When to Harvest

The first control point for corn silage production is the decision of when to begin harvest. Whole plant moisture content is the best harvest trigger to use because of its relationship with fermentation and digestibility (1). The trigger range suggested is 30 to 35% whole plant dry matter for horizontal silos and 35 to 40% for vertical silos.

Length of Cut

Once the decision has been made to begin the harvest, particle size of chop is the next critical control point. Particle size affects the ability to pack the silage. Dry forages do not pack as tightly as wet, and the density or tightness of packing within the bunker affects the fermentation process in the silo. In more densely packed silage more oxygen is excluded, reducing the length of the respiration phase of the ensiling process. Reducing respiration decreases the potential for heat-damaged proteins and loss of dry matter (DM). Well-packed corn silage also reduces the potential for mold growth because oxygen is limited. Finally, the more rapidly the silage moves from respiration to anaerobic fermentation, which pH drops and the “pickling” of the silage takes place, fewer undesirable by-products will be produced. In the end, the by-products of this “pickling” affect feed intake and digestibility. Therefore, particle size of corn silage ends up being very important.

Traditionally, researchers make a recommendation concerning a theoretical length of cut (TLC) of about 3/8 inch (2) for corn silage that is 30 to 35% DM and not processed...
through a roller. This recommendation takes into account the fermentation within the silo, the nutritional needs of the cow, as well as the ability of the chopper to do its job. But, the research tends to be somewhat confusing (3); moisture in the grain portion, whether corn silage is the primary forage, and even the forage needs of the animals, all affect the optimum length of cut. For most conditions, a TLC of 3/8 inch is a good compromise. This usually can be preset by adjusting the chopper, but changing field conditions will require constant monitoring and adjustment. Most producers have no “on-farm” way to specifically determine if the TLC is correct. This raises the question of how to consistently determine whether the corn plant is being chopped adequately or inadequately for any given field.

The Penn State particle separator (shaker box) supplies a simple and effective “on-farm” way to quantify chopping results. The shaker box has a series of two or three (depending on the model) consecutively smaller sieves through which forages or TMRs are shaken. The materials remaining on top of each sieve and in the bottom pan are then compared against the total volume of the original sample. The objective in most cases is to maximize the amount on the middle sieve at somewhere near 45% to 65% of the total material (Table 1, page 6). When corn silage is the main forage this number should be closer to 65% (2).

To better balance the packing and fermentation potential of the silage, the amount in the lower sieve should be in the 30% to 40% range.

**Processing Corn Silage**

A practice that has gained acceptance in recent years is processing corn silage with a roller mill in the field as it is harvested. Processing reduces large particle size by breaking up cob disks and unbroken kernels. The aim of processing is to reduce the amount of waste in the feed bunk and improve digestive accessibility for the nutrients in the kernels. Because processing the corn plant generally reduces final particle size, the initial chop length of the silage needs to be larger with a TLC of 3/4 inch. The rollers in the processor should be set to crush the cobs and fracture the kernels but not crush them so finely that the kernels will be broken into many small pieces. The corresponding Penn State particle separator scenario would point to 50% to 75% of the sample being on the middle sieve and the upper sieve would have slightly more as well (2).

**Speedy Delivery, Packing**

Following adjustment for particle size, the next critical control point for corn silage production is speed of delivery to the silo and packing. We already understand that tightly packed silage reduces respiration and heating, which improves silage quality. Packing and speed of delivery are important because these two issues relate back to the ability to exclude oxygen from the silage during fermentation.

The targeted density of a corn silage bunker is 14 lb/cu-

bic foot of volume (4). At this density an optimal amount of oxygen has been displaced or pressed out of the silo. Silage densities less than 14 lb/cubic foot tend to have greater DM loss. Silage densities higher than 14 lb/cubic foot do not have significantly less DM loss. Measuring silage density directly is difficult to do on-farm.

Researchers in Wisconsin have identified the following five factors related to adequate packing: tractor weight, packing time, DM content, layer thickness, and crop delivery rate (5).

**Tractor Weight is Important**

Tractor weight is important because lighter tractors require more time per ton of silage to pack compared with heavier tractors. Packing time is crucial because enough time per ton delivered must be allowed to get optimal oxygen exclusion, regardless of tractor size. As was pointed out above, adequate moisture content is important because it affects “packability”. Because greater layer thickness requires more packing than a thinner layer, limit the size of each layer of chopped plant material in the bunker to 6 to 12 inches before packing. Finally, the rate of crop delivery becomes important because it must be coordinated with the tractor/time scenario available to each farm.

Another way to look at this suggests a tractor of a certain size and weight can only pack a fixed amount of silage each hour. Exceeding this packing rate with the delivery rate can only mean that the density of the silo is less than the optimal 14 lb/cubic foot. So the packing rate ideally should meet or exceed the delivery rate (4). Several methods for ensuring coordination of delivery and packing rates have been suggested. One of the simplest uses the formula:

\[
\text{packing rate (tons/hr)} = \frac{\text{combined weight of tractors (lb)}}{800}
\]

This number also can be considered the maximum rate of delivery for each farm situation.

By having positive control over the processes in silage production, variation in feed quality can be reduced. This in turn will set the stage for better animal health and milk production for the dairy herd and increase potential for profitability.

**References**
