Avoiding Losses During Harvest

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High quality corn silage does not just "happen". High quality corn silage is planned for. And, as with any process, there are control points where an incorrect decision improves or reduces the quality or value of the final product. Conversely, a correct decision can improve the feed quality and aid in making more milk. Understanding and using these control points is where the good managers are separated from the best managers. So a look at some of these control points is probably valuable.

The first control point for corn silage production is the decision of when to begin harvest. In a previous MDR article (1), whole plant moisture content was identified as the best harvest trigger due to its relationship with fermentation and digestibility. The trigger range that is suggested is 30% to 35% whole plant dry matter. Though once the decision has been made to begin the harvest, particle size becomes a significant control point. Particle size affects the ability of the silage to pack. Dry forages do not pack as tightly as wet. The density or tightness of packing within the bunker affects the fermentation process in the silo. In more densely packed silage more oxygen is pressed out, reducing the length of the aerobic portion of the fermentation cycle. Reducing this part of the fermentation cycle lowers the potential for heat-damaged proteins and loss of dry matter to aerobic fermentation. Well-packed corn silage also reduces the potential for mold growth because oxygen is limited. Finally, the more rapidly the silage moves from aerobic to anaerobic fermentation, where ph drops and the "pickling" of the silage takes place, the more desirable by-products will be manufactured. In the end, the by-products of this "pickling" affects how effectively the cow digests the feed. So, the range of particle sizes in the bunker ends up being very important.

Traditionally, researchers make a recommendation concerning a theoretical length of cut (TLC) of about 3/8 of an inch (2) for corn silage that is about 30% to 35% dry matter and not a brown midrib variety or processed through a roller. This tries to take into account the issues of fermentation in the silo, nutritional requirements of the cow, as well as the engineering relating to actually chopping the corn plant. 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 to be fed, all impact the length of cut that is called for. In the end, the 3/8 of an inch number is probably a good compromise as a working number because most producers have no way to specifically determine the TLC on the farm. This raises the question of how to determine whether the corn is being chopped adequately or in adequately for any given field.

The Penn State Shaker-box supplies a simple and effective "on-farm" way to quantify and qualify chopping results. The shaker-box is essentially a series of two or three (depending on the model) consecutively smaller sieves through which forages or TMRs are shaken. The materials remaining on each sieve and in the bottom container are then compared against the total volume of the original sample. The general objective in most instances is to maximize the amount on the middle sieve at somewhere near 45% to 65% of the total material. But when silage is the main forage then this number should be closer to the 65% figure (2).

To better balance the packing and fermentation potentials of the silage, the amount in the lower sieve should be in the 30% to 40% range. And as corn silage become a larger portion of the ration, less and less of the total should appear on the top sieve or bottom pan. But, the top and bottom sieves should never be completely empty.

Recommended Particle Distribution for

Penn State Particle Separator

Screen	Particle Size	Recommended Percentages
Upper Sieve	>0.75"	3% - 8%
Middle Sieve	0.31" - 0.75"	45% - 65%
Lower Sieve	0.07" - 0.31"	30% - 40%
Bottom Pan	< 0.07"	< 5%

(2)

A practice that has gained acceptance in recent years is processing the corn silage with a roller mill as it is being harvested. The intention is to reduce large particle size by breaking up cob disks and unbroken kernels. This will reduce the amount of waste in the feed bunk and hope to improve digestive accessibility to the nutrients in the kernels. Because processing the corn plant generally reduces final particle size, the initial chop length of the silage need to be slightly larger. A TLC of 0.5” to 0.75” is called for. The rollers in the processor should be set at about the thickness of a dime. The corresponding Penn State Shakerbox 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).

Following particle sizing, the next crucial management junction for corn silage production is speed of deliver to the bunker and packing. We already understand that tightly packed silage reduces heating and aerobic fermentation and improves potential 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 lbs/cubic foot of space (4) At this level of density an optimal amount of oxygen has been displaced or pressed out of the silo. Silos with densities less than 14 lb/cubic foot tend to have more dry matter loss and silos with greater densities do not have significantly less dry matter loss. While there are tools and mechanism for measuring density directly, it is not always possible to do so. So, some other methods were needed to endure adequate packing. Researchers in Wisconsin have pointed to five factors, which relate to adequate packing. They are; Tractor weight, packing time, dry matter content, layer thickness, crop delivery rate (5).

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 must be allowed, regardless of tractor size. As was pointed out above optimal dry matter is important because it has a connection with the corn silage's "packability".   Because greater layer thickness requires more packing than lesser layer thickness to achieve the same result, the researchers found that it was important to keep each layer of silage in the bunker at 6" to 12". 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 these rates have been suggested. One of the simplest uses the formula;

$$\frac{\textbf{Tractor weight}}{\textbf{800}} = \textbf{Packing rate per hour for that (those) tractor(s)} \quad (2)$$

This formula works silos using one tractor or multiple tractors for packing. This can also be considered the maximum rate of delivery for that situation.

Once these concepts are incorporated into a corn silage production plan, management will gain new control over the feed production system. By having positive control over new potions of the silage production process, variation in feed quality can be reduced. This in turn will set the stage for better production potential for the dairy herd and increase potential for profitability.

References

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