

FACT SHEET 1: Corn silage kernel processing

Joe Lawrence and Allison Kerwin

The value of whole plant corn as a forage (corn silage) can largely be categorized by two contributions to animal nutrition: fiber and starch and the digestibility of each. In terms of starch, focus is often on total content and digestibility. However, kernel processing addresses a third factor: accessibility. Since a large portion of the starch is inside the kernel and protected by the seed coat it contributes very little to cattle nutrient needs and typically passes through the animal as a whole kernel.

For cattle to fully utilize the nutritional value of corn silage the seed coat must be broken to allow rumen bacteria to access the starch inside. This has led to continuous improvements in mechanical kernel processing (kernel breakage) over the last few decades and a standardized method for laboratory analysis of kernel processing, commonly referred to as Corn Silage Processing Score (CSPS).

The standard procedure for CSPS is done in a laboratory setting where the sample is shaken through a 4.75 millimeter sieve and the percent of the starch passing through the sieve is recorded. Industry guidelines for CSPS interpretation first proposed by Dr. David Mertens are presented in **Table 1**.

TABLE 1

Corn silage CSPS guidelines used by commercial forage laboratories

Corn Silage CSPS, %	Rating
< 50	Inadequate
50 to 69	Adequate
> 70	Optimal

As awareness of the importance of CSPS has increased and harvesting equipment has been upgraded commercial laboratories have reported year-after-year improvements. This progress is encouraging though this data also suggest there is still room for improvement.

During the 2018 and 2019 growing seasons the New York Farm Viability Institute funded a project led by Cornell PRO-DAIRY to better understand a number of field factors related to CSPS. Project collaborators include: Cornell Cooperative Extension, Miner Institute, SUNY Morrisville, Cornell University Ruminant Center, Corteva Agri-Science, Seedway, Dairy Support Services, Pominville Dairy, Hilltop Divine Dairy and Kingston Farm.

IMPLEMENTING KERNEL PROCESSING

The addition of a kernel processor on new harvesters is nearly universal and several aftermarket units are available. Addition of a kernel processor may require greater horse power requirement to run the harvester but is well worth the investment.

Field experience has also led to a number of adjustments to processors to increase their performance. Equipment specifications should be considered when making changes. Potential modifications include:

- adjusting the speed differential of the rollers to more aggressively break the kernels
- increasing number of ribs on pulley and belt to reduce belt slippage
- adjusting spring tension (*Note: overtightening rollers can lead to more bounce in the rollers that reduces uniformity in kernel breakage.*)

MONITORING PROCESSOR PERFORMANCE

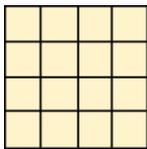
Having a kernel processor installed does not equate to adequate processing. Monitoring, adjustment and maintenance are critical to optimize its use.

Monitoring processor performance has different aspects. Several tons of forage can be harvested per hour so improper performance for a short time can equate to large quantities of forage that is not adequately processed.

A number of in-field methods offer quick assessments during harvest. General guidelines include having every kernel at least cracked in half, though it should be noted that a kernel needs to be approximately 1/12 of the original kernel size to pass through the 4.75 mm sieve used in the lab. **Figure 2** provides a visual of 4.75 mm sieve size.

FIGURE 2

Grid of 4.75mm openings (*when printed on 8.5"x11" paper*).



Methods to assess this include using the Penn State Particle Separator (PSPS), the 32 oz plastic cup method, or the bucket of water method.

Penn State Particle Separator – a sample of known weight is sifted over a stack of screens of different sizes that separate larger particles from smaller and allow better visualization of kernels. The lower sieve is slightly smaller than 4.75mm (at 4.06mm).

32 oz cup method - originated with the idea that there should be less than two whole kernels in a full cup. However, as guidelines have become more aggressive over the years, it is now suggested that the cup contain zero whole kernels.

Bucket method - based on the idea that the stover (of green forage) will float in water while the kernels sink to the bottom. This allows for a quick separation of kernel pieces from stover, which allows for more thorough visual assessment of the kernels.

Phone app - The University of Wisconsin released a phone app ([Silage Snap](#)) that can be utilized in conjunction with methods above that sort kernels.

Laboratory analysis - Lab analysis is the gold standard and can be valuable. However, during harvest the turnaround time may not be quick enough to effectively make in-season adjustments.

Multiple approaches can be effective. The key is to find the right fit for your operation and to develop a plan to make sure performance is checked frequently during harvest. Assigning someone at the silo to check samples at a defined interval (every few hours or each “x” load) will improve success.

Larger maintenance items include wear items such as the rollers, belt and springs that should be monitored throughout the season. Consult with manufacturer guidelines on replacement schedule which may be based on tonnage, acres or hours of operation.