

Kernel Processing Information Series

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FACT SHEET 2: Effect of corn plant characteristics on corn silage processing scores

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When evaluating corn silage, the focus is often on total yield. However, when thinking about the harvesting process, and specifically the task of a kernel processor to break apart corn kernels, it is important to consider plant characteristics that may influence how the processor performs and the resulting Corn Silage Processing Score (CSPS). Plant characteristics measured in a recent study include:

- ear to stover ratio
- whole plant dry matter (DM)
- ear DM

For this study, four hybrids with varying characteristics were harvested with the same harvest equipment to evaluate differences in CSPS. Hybrid characteristics are presented in **Table 1**.

TABLE 1

Characteristics of the four hybrids evaluated as defined by the seed company and measured by study (ear to stover ratio).

Hybrid Code	Relative Maturity	Hybrid Description	Plant Height Rating	Average Ear to Stove Ratio, 100% DM
1	97	Dual	6 out of 9	1.44
2	98	Leafy	9 out of 9	1.14
3	91	Dual	4 out of 9	1.62
4	100	Leafy	9 out of 9	1.13

An ear to stover ratio of 1:1 indicates that the ear weight was equal to the stover weight (100 percent DM), while an ear to stover ratio higher than 1:1 indicates that the ear weight was greater than the stover weight.

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.

Whole plant DM did not have a significant impact on CSPS; however, the impact of ear DM was significant. Based on this analysis, a predictive formula can be developed to estimate the change in CSPS (**Table 2**).

TABLE 2

Predicted change in CSPS from changes in ear to stover ratio and ear DM.

	Unit Change	Resulting Change in CSPS, %
Ear to Stover Ratio, 100% DM	+ 0.10	+ 1.7
Ear DM	+ 1.0	- 0.78

The use of hybrids with different characteristics and the impact of growing environment observed over the two growing seasons covered by this project (2018 and 2019) provides an opportunity to understand the extent to which ear to stover ratio and ear DM can impact CSPS.

While we know that hybrid type can have a significant impact on ear to stover ratio (**Table 1**), comparing the two seasons used in this study shows that growing environment can impact the magnitude of this difference between two hybrids. In this dataset, differences in ear to stover ratio within location ranged from approximately 0.5 to 0.9. This means ear to stover ratio could explain 8 to 15 percentage units of difference in CSPS between the hybrid with the lowest ear to stover ratio and the hybrid with the highest ear to stover ratio, depending on location.

When comparing the same hybrid across locations, the magnitude of difference varied by both growing conditions at different locations within a year and between years. In 2018, hybrids were grown at five different locations and the difference in ear to stover ratio between locations ranged from approximately 0.2 to 0.9 which could explain a 3 to 15 percentage unit difference in CSPS. In 2019, the difference ranged from approximately 0.6 to 0.9 which could explain a 10 to 15 percentage unit change in CSPS.

The amount of variability measured, both between hybrids and hybrid response to growing conditions, and the potential impact it can have on CSPS highlights the need to continuously monitor performance during the growing season.

At the target stage of maturity (35 percent whole plant DM) for corn silage harvest, ear DM is generally much greater than stalk DM but can be influenced by growing conditions and overall plant health. While whole plant DM is the metric used to target harvest timing, achieving a higher ear DM is important as it is an indication of kernel maturity. Total starch content increases as the kernel matures and is relevant in considering how well the kernels can be processed.

Once again, looking at within location differences gives an indicator of the range in ear DM between hybrids under the same growing conditions. Similar to ear to stover ratio, the model for ear DM derived from this data shows that range within location could be meaningful to CSPS as the potential impact of ear DM on CSPS fluctuated from approximately 5 to 12 percentage units.

Hybrid was highly significant in the analysis, indicating that while ear to stover ratio and ear DM were both significant, other hybrid characteristics (or genetic factors) not measured in the dataset could also influence CSPS.

It is important to recognize that the expected variation in CSPS is influenced by a number of factors and even with the factors measured here, the variation is quite high. This project does show that these factors have the potential to be meaningful and growers should pay attention to these factors throughout the harvest season to assure satisfactory processing.

FECAL STARCH AND KERNEL PROCESSING

Another area of research over the last few decades has been the measurement of fecal starch from manure samples to help producers and nutritionists better understand how much starch in the diet is being utilized by the animal and how much is wasted (passed through the cow). Guidelines adapted from the University of Wisconsin suggest the following interpretation of Fecal Starch values (**Table 3**).

TABLE 3

Fecal starch interpretation.

Fecal Starch, %	Interpretation
<3%	Optimum Digestibility
3-5%	Sub-Optimum Digestibility
>5%	Evaluate Individual Feeds

Data from Penn State (Ferguson) reports that each one percent increase in fecal starch translates to a loss of 0.72 lbs. of milk.

When considering these two topics, it is easy to see the connection between them. This has led to various efforts to collect information on the relationship between these values. An example of this is a survey of over 70 dairy farms by Vita Plus that reports a 3.99 percent average fecal starch when CSPS was greater than 60, while the average percent fecal starch when CSPS was less than 50 was 6.67 percent. When considering the interpretation of fecal starch (**Table 3**) and its connection to CSPS, it is evident that the impact of these plant characteristics is meaningful to the cow.