W 1039

Harvesting Corn Silage:

Importance of Moisture and Some Tools You Can Use

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Corn silage comprises the largest percentage (50 to 75 percent) of forages in most dairy cow diets. To maximize digestibility and quality, corn silage needs to be harvested at the correct whole plant dry matter (**DM**) content, the portion of the plant that is not water. Harvesting corn at too low a DM could reduce the total amount of starch available, reducing the energy availability when fed. Lower energy corn silage requires additional supplements added to the diet to prevent losses in milk production and increases the risk for leachate, and slower fermentation, which leads to unfavorable volatile fatty acids ratios. On the other hand, harvesting corn at too high a dry matter could lead to higher lignin content that is less digestible. Higher dry matter, 37 or greater, leads to mold and yeast potential as well as packing and porosity issues, which lead to dry matter loss, a loss of aerobic stability, and secondary fermentation. Also, fermentation will be reduced, as well as a decrease in starch digestibility and kernel processing. Generally, the target DM to harvest corn silage is 35 percent. If a kernel processor is used, harvest DM could range from 32 to 38 percent.

IMPORTANCE OF HARVESTING CORN AT THE CORRECT DM:

- Corn plants remain between 22 to 28 percent DM for a long time as the ear starts to form and the kernel starts to dent. Dent occurs as the moisture in the kernel decreases and starch content increases.
- After 28 percent DM, corn plants typically lose 0.5 percent moisture per day.
- At just over 32 percent DM, kernel dent becomes visible (Figure 1). As kernel dent increases, the harder the kernel gets and the more starch it contains.
- After the dent becomes visible, starch increases by roughly 1 percent every two days. Starch in the kernel increases the weight of the corn plants, with 50 to 60 percent of the plant weight being ear.
- Another visual sign to look for is the milk line. The milk line is the progression of starch moving up the kernel. A milk line 1/2 to 3/4 up the kernel should coincide with ideal moisture content for harvest. Pulling off an ear and breaking it in half is an easy way to check this. Seasonal variation and variety can alter the ear dry down/ stalk dry down ratio.

FIGURE 1. *Dent in corn kernels. (photo credit: Liz Eckelkamp)*

FIGURE 2. *Milk line in corn kernels. (photo credit: Liz Eckelkamp)*

- Corn harvested at 35 percent DM will maximize starch content in the ear/grain by allowing the ear to fully develop and reducing the moisture content in the corn without reducing digestibility.
- Corn harvested over 38 percent DM can develop fungal and mycotoxin problems. As moisture decreases, it becomes more difficult to densely pack corn and increase porosity. Think of trying to pack dry hay together versus wet grass. Since silage requires an anaerobic (air hating) environment, packing fresh cut silage densely in a bunker, bag or silo is extremely important to promote fermentation. Corn harvested at greater than 38 percent DM will not pack as well, allowing air in and fungus and mold to develop and create mycotoxin problems.
- At over 45 percent whole plant DM, a black layer is formed in the kernel. Black layer typically happens at ear moisture of 35 percent. Processing of corn becomes difficult at this point and digestibility is reduced. Kernel moisture of around 40 percent and below will make processing difficult and result in a lower corn silage kernel processing score (**CSKPS**), even if processed at correct whole plant dry matter. This will create higher total ration fecal starch levels and loss in production. For every 1 percent increase in fecal starch 0.72 lbs. of milk production can be lost.

MONITORING DRY MATTER:

Tracking the whole plant DM can help pinpoint the ideal harvest time. Weather, time, equipment availability and ration needs all influence harvest time. However, having an ideal harvest time may assist with planning or scheduling custom harvesters. These tools can make this process easier.

- The Corn Growing Degree Day (**GDD**) decision support tool (available at **mrcc.purdue.edu/U2U/gdd**) created by Useful to Usable (U2U) summarizes historical climate data of an area to help determine the approximate time of corn silking and black layer formation in the kernel with the corresponding GDD. Growing Degree Days are directly related to the corn plant growth and development stages. You can use the "About GDD" option to get access to U2U Decision Support Tool User Guide that provides detailed instructions on how to use this decision support tool.
- This tool can be adjusted to reflect your farm location, the variety of corn planted and the date of planting. Remember, each year is different, so use this tool as a guide, not as the only measure to determine harvest.
- Once silking is determined, adding around 750 to 800 GDD, depending on the relative maturity (**RM**) of the specific hybrid you planted, will provide the estimated date when corn should reach 31 to 32 percent whole plant DM. A study by Bill Cox at Cornell University suggested adding 750 GDD for 96 to 100 RM and 800 GDD for 101 to 115 RM to reach 31 to 32 percent whole plant DM. **This is the time to start checking your fields using a chipper-shredder.** After the whole plant DM reaches 32 percent, wait for about 6 days to harvest corn. As corn plants typically lose 0.5 percent moisture per day, it will take approximately 6 days for the corn plant DM to reach 35 percent from 32 percent.

ROLE OF A CHIPPER-SHREDDER IN DRY MATTER MONITORING:

- A chipper-shredder (Figure 3) can be used to approximate corn silage harvesting with a small number of representative plants.
- Randomly select five to 10 corn stalks from each field.
  - » In a uniform field, collect five randomly selected stalks from across the field.
  - » In a variable field, collect 10 randomly selected stalks from across the field. The size of the field does not really matter. However, as the field size increases, the uniformity of the field may decrease.
- Run the entire corn stalk through the chipper end first with a collection bag connected to the outlet. Second, transfer the chipped corn stalk into an extra bucket and replace the collection bag on the exit of the machine. Next, dump the chipped corn stalk into the shredder end to reach a uniform size. *Note: You may need to run samples through the shredder end more times to reach a uniform size, depending on whole plant dry matter.

FIGURE 3. *Chipper-Shredder diagram with additional tools. (photo credit: DR Power)*

DETERMINING DRY MATTER CONTENT:

- After creating a uniform sample, determine dry matter content by using a Koster tester, microwave, dehydrator, NIR analyzer or by submitting samples to a forage laboratory. To learn about how to use a Koster tester, view resources at the **UT dairy webpage**.
- Forage samples can be submitted to the UT Forage Analysis Lab at **soillab.tennessee.edu/forage-analysis**. *Note: When submitting samples to a forage laboratory, be sure to indicate it is green chop and not ensiled corn silage.
- If you need help with pulling forage samples or using a Koster tester, reach out to your local Extension agent.

OTHER RESOURCES:

- The OneSoil app (**app.onesoil.ai**) is a useful tool to determine the uniformity of a specific field before taking samples. You can select a specific field in the app and it will show whether the field is uniform through different color gradients (green or yellow).
- UT Dairy Extension has invested in providing several chipper-shredders to county Extension offices across the state. If you would like to use these tools, please contact **your local county Extension agent** or Liz Eckelkamp, UT dairy Extension specialist, at **eeckelka@utk.edu** or 865-974-8167 for more information.
- Video resources on corn silage harvest and the use of chipper-shredder by John Winchell from Alltech can be found at the **UT Department of Animal Science YouTube channel**.

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