Production of high quality corn silage relies on several variables coming together simultaneously. The variable often overlooked is arguably the most important, the timing of the harvest. Regardless of silo type, or post harvest management, corn silage harvested either too late or too early can never be transformed into the excellent forage source required by high producing dairy cattle. Only starting the ensiling process with chopped forage having the right characteristics will produce high quality corn silage. Consequently, management of harvest timing is a primary starting point to high quality corn silage. The measure that will point us to the appropriate harvest timing is the digestibility of the neutral detergent fiber (NDF) in the corn at harvest. Digestibility of NDF tells us something about how useful this forage will be as a candidate for ensiling and as a source of nutrients for the cow.

Highly digestible corn will make highly digestible corn silage and less digestible corn will make less digestible corn silage. To better understand digestibility in the corn plant and its potential influence on corn silage production, consider what is generally occurring as the plant nears harvest time. Early on the plant is very digestible, high in fiber, high in sugars and low in starch. Sugar is initially produced and stored in the plant tissues, but migrates to the kernels as they fill out, eventually depositing as starch when the plant matures and dries down. If the harvest occurs before the kernel has dented, the fermentation process would lead to energy storage in the silage as sugar. When consumed by the cow, this sugar is digested so rapidly the cow does not receive its full nutritional benefit. This is also a time when the corn plant is fully hydrated, and the ensiled forage would produce excessive amounts of seepage, draining away valuable nutrients and promoting poor fermentation in the silo.

As the corn plant continues to mature, there comes a point when the kernels are full and the sugar in them begins a transformation into starch. At the same time and associated with weather and plant maturity, the total moisture level in the plant begins to decrease. We visually recognize this period as the time when the kernel moves from being soft and fluid filled through the dough stages, then forming a dent and followed by the milk line dropping to the base of the kernel. When the milk line disappears the black line forms within the kernel. During this time the plant becomes more fibrous and ultimately more difficult to chop into uniform particles. At the end of this period, crude protein and digestibility levels have also decreased. Ensiling this material would be difficult. Silage that is dry will not pack densely, allowing air pockets to form, retarding the anaerobic fermentation process from completion. Molds develop under these conditions as well. The kernel has also hardened and become less digestible.

If allowed to take place, harvesting at the wrong maturity adversely impacts silage quality. Early harvest will produce silage, which has a reduced nutritional value due to seepage and poor fermentation. Delaying harvest decreases the digestibility of the resulting silage. But somewhere within that range, from too early to too mature lies a time of optimum harvestibility. In this period, moisture is adequate for fast fermentation and the plant is not yet too fibrous to chop evenly. The sugar in the kernels has made the transformation to starch, yet the shell has not completely hardened. The question is how to determine this optimum period?

Many methods for timing harvest have been suggested by researchers and used by producers. Observing the “milk line” or the progress of a “black line” within the kernel to foretell harvest criteria are tests that have received wide use. These unfortunately are tests that rely on the assumption that all corn is created equal and everything will average out each year. Those assumptions are usually incorrect.

For these tests to work as advertised, all corn hybrids must dry at the same rate and have similar NDF digestibilities at any point in time. Each hybrid must reach the optimum place on the milk line, for example, at the same state of whole plant moisture. Unfortunately they don’t. Different hybrids will reach different levels of whole plant moisture at different places on the “milk line”. In many cases this method of timing will end in moisture levels too high or too low to support an optimal and complete fermentation. Resulting in something less than the high quality corn silage that was originally planned.

Research from Michigan State University (1) indicates that the best method for timing harvest is through the monitoring of whole plant moisture. Because moisture content is the key excellent fermentation, monitoring moisture for harvest timing provides a consistent way to plan for harvest. This consistency can be used from year to year regardless of weather and hybrid type. The ideal moisture range for ensiling corn is from 65% to 70% whole plant moisture. Going outside this range promotes poor fermentation, loss of nutrients, low digestibility and the formation of undesirable byproducts which will reduce feed quality. The type of storage facility it is destined for will influence moisture level for harvest. " Bag" silos and horizontal (bunker) type silos have a recommended range of 65% to 70% whole plant moisture at harvest. Upright silos do best with corn harvested between 60% to 65% and oxygen limiting silos can receive corn with a 50% to 60% moisture content. The recommendations for moisture levels below 65% moisture correspond to the need for a finer length of cut to promote better packing and oxygen exclusion during storage. The upright and oxygen limiting silo types do not have means to mechanically pack the forages. The finer cut forage allows the silo to "self" pack more easily. Closely packed forages also minimize losses due to runoff and heating ().

To determine the appropriate time for harvesting a particular field, moisture levels from a representative group of corn plants must be measured. Recommendations are for a total of 10 entire corn plants (Leaves, ears, tassel and stalk) to be harvested from several locations within the field. Chop these into pieces at least one inch long. The forage harvester or a wood chipper can be used to do this. Next the chopped materials must be thoroughly mixed and the entire mixture evenly reduced to a size that will fit in the drying device. To do this, the chopped material is first placed on a tarp or plastic sheet on the ground. One at a time each corner of the tarp is raised in the air so that the mixture is rolled over itself at least halfway, and then the tarp is set back on the ground again. Continue this procedure one corner at a time around until each corner is lifted at least once. Though more than once is preferable. Then evenly divide the mixture on the tarp in half and discard one of these halves. Continue to divide and discard the remainder until the remainder will easily fit into the drying device to be used. This rolling and dividing procedure is designed to ensure that the final sample represents all parts of the field and all parts of the corn plants in the field

The percent moisture is determined by drying and weighing the final sample to determine the amount of water that is contained in the sample. For drying a Koster® type test unit or a microwave can be used to dry the sample. Determine the percent moisture of the whole corn plants in the targeted field using the following two formulas:
(Initial weight of the sample - Dry weight of the sample) = Weight of the moisture in the Initial sample.
Then the formula
(Weight of the moisture in the Initial sample / Initial weight of the sample) X 100 = Percent moisture in the field.
If the percent moisture of the sample is appropriate for the type of silo being filled, proceed with harvest. Otherwise continue to monitor until the moisture level closes with the desired level.

Timing harvest through the use of moisture is a system through which producers can create a control or base point from which to begin the process of creating high quality corn silage. Once a control point is determined the quality of the final product can be better managed and positively affected. Because the final quality corn silage is directly related to the moisture and development of the corn it was created from, selecting the proper time for harvest is absolutely critical.

References

1. Fiber Digestibility of Forages, Allen, M., M. Oba, 1996, Proc. 57th Minnesota Nutrition Conf.,
2. Corn Silage Production, Management, and Feeding, Roth, G., Undersander, D., 1995, American Society of Agronomy

The following internet link describes a method for determining moisture using a microwave (http://ohioline.osu.edu/agf-fact/0004.html).