Silage Harvest Moisture Recommendations and Analysis

Timing of silage harvest is critical to harvesting and maintaining high quality forage. Harvesting at a higher than recommended whole plant moisture content reduces the energy value and overall quality of the forage. It also increases the risk of poor or slow fermentation and the possibility of valuable feed component losses to seepage during ensiling. Harvesting at lower than recommended moisture content reduces digestibility of the forage and could lead to complications packing the silage and subsequent problems maintaining silage quality through all phases of storage, especially feed-out. Recommended whole plant moisture content at chopping is dependent on the method of storage. See Table 1 for optimal harvest moisture by storage method.

Table 1. Optimal Harvest Moisture Content by Storage Method

Storage Method	Moisture Content (%)
Upright Silo	60-65
Upright "oxygen-limiting" Silos	50-60
Horizontal Silos	65-70
Bag Silos	60-70

Source: University of Wisconsin

Estimating Whole Plant Moisture

Assessing whole plant moisture content should include samples or observations from several representative areas of the field. Changes in field topography, soil moisture, or fertility levels are just a few examples of variables that can interact with hybrid performance and maturity. The best practice is to consider the variability of the farm, and sample sub-field environments to give an accurate estimation of whole plant moisture across the farm.

Using Kernel Milk Line to Estimate Moisture Content

Evaluating kernel milk line is a useful way to obtain a *preliminary estimate* of whole plant moisture content. The kernel milk line becomes visible near the cap of the kernel (outside end, furthest away from the cob) at the dent stage (R5). As plant maturity progresses from early dent to physiological maturity (R6), or black layer, the milk line slowly migrates from the cap of the kernel to the base, or cob end, of the kernel. To estimate kernel milkline, break several representative ears in half, and observe the face of the break on the half representing the top of the ear (tip half), as shown in Figure 1. The milk line is the point on the kernel where the darker, firm area transitions to a lighter colored, softer area. This lighter area will still contain a liquid, milky substance, whereas the dark, firm area has already matured to a solid, starchy endosperm. If the milk line is not clearly defined, a good practice is to use an ink pen and draw a straight line from the dented end of the kernel to the cob end. Use slightly more pressure compared to what you would use if writing on paper. The milk line will be slightly above where the pen breaks through the exterior of the kernel and yields the milky endosperm. If the ink pen doesn't break through the kernel, check the kernel at the location where it attaches to the cob to see if it has already black layered. Table 2 shows

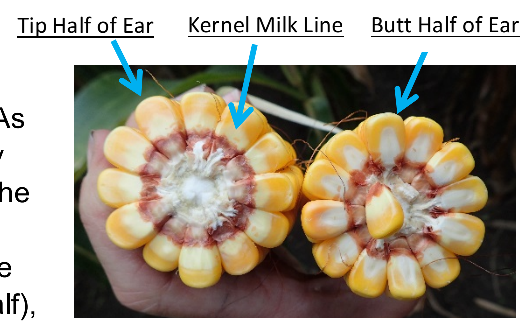

Figure 1. RC5112-3011A at silage harvest

estimated whole plant moisture at various stages of development between early dent and full maturity, or black layer, when there is no (zero) milk line.

Table 2. Whole Plant Moisture by Stage of Development

Stage of Development	Estimated Whole Plant Moisture (%)
Early Dent	73
½ Milkline	66
¾ Milkline	63
No milkline	60 or lower

Adapted from University of Wisconsin

Using a Microwave Oven to Determine Actual Moisture Content

A microwave oven is a simple and effective tool for assessing whole plant moisture content. This methodology for determining whole plant moisture content of silage using a microwave oven is adapted from the August 2012 University of Nebraska CROPWATCH newsletter. In addition to fresh chopped silage and a microwave oven, you will need an air-tight container (e.g. a one-gallon size plastic freezer bag), a microwave safe kitchen plate (or microwave dish), and some type of scale (a kitchen scale will work). Use a scale that provides accuracy down to 1.0 gram.

Step 1. Secure a representative sample from the field. Cut six or more representative plants at the same cutting height that you plan to use when chopping the field. Either manually chop the plants into lengths of ½ inch, or run the samples through a mechanical chipper/shredder. Collect a representative sub-sample (or two) from the chopped silage. Place the sample(s) in the airtight container(s) as quickly as possible and store it in that container until you get to your microwave oven (preferably on ice in a cooler if drying will be delayed for 30 minutes or more).

Step 2. Weigh the microwave safe plate you plan to use to dry the sample and record that weight (do not use a paper plate).

Step 3. Place a portion of the sample on the microwave safe plate. Spread the sample evenly across the plate, shallowest in the middle and no more than 1 ½ inches deep at the edges. Weigh the sample, including the plate. Record the total weight. Subtract the weight of the plate to determine your fresh sample weight and record that value.

Step 4. Place the plate and sample in the microwave oven to begin the drying process. Program the microwave for two minutes on high power.

Step 5. At the end of the first 2 minutes, remove the sample and plate, reweigh, and record the weight.

Step 6. Stir the sample and place it back in the microwave for an additional two minutes on high. Continue drying, initially using increments of two minutes and then shortening the cook time to one minute as the sample becomes more dry, and re-weighing the sample each time until the same weight is recorded for two consecutive drying cycles. The same weight after two consecutive drying runs indicates a fully dried sample. *(Note: The length of time needed to completely dry the sample depends on the wattage of the microwave and the evenness of heating. If your microwave does not have a turntable, be sure to re-orientate the sample between heating cycles.)*

Step 7. Subtract the final dried sample weight from the fresh sample weight. This provides the weight of the moisture in the fresh sample.

Step 8. Divide the weight of the moisture by the fresh sample weight. This provides the percent moisture of the fresh sample, which may be used to time optimal silage harvest.

Table 3. Example of silage moisture content determination using a microwave oven

Measurement	Example
Plate weight	10g
Plate and sample weight	110g
Fresh sample weight (total weight minus plate weight)	110g -10g = 100g
Plate and sample weight after 1st drying cycle	55g
Plate and sample weight after 2nd drying cycle	40g
Plate and sample weight after 3rd drying cycle (weight is the same as the previous drying cycle; the sample is fully dried)	40g
Total weight after final drying cycle minus weight of plate = dry sample weight	40g - 10g = 30g
Fresh sample weight minus dry sample weight = weight of the moisture in the sample	100g - 30g = 70g
Weight of moisture in the sample divided by fresh sample weight multiplied by 100 = % moisture of fresh sample	70g/100g x 100 = 70%