



## Measuring Moisture in Forages

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The amount of moisture contained in a forage crop at the time of ensiling or baling is critical for maintaining a high quality feed. Also, moisture at time of feeding can make a big difference in the pounds needed to balance the ration. This is true for all forages whether corn silage, small grain silage, hay-crop silage, or hay. Decisions concerning timing of harvest or storage can be made correctly if an accurate estimation of moisture can be made. Sometimes this can be done by visual and physical observation, especially with the corn plant, but this is more difficult with hay-crop silage or hay since over or under wilting can result in a poor quality product. Therefore, to aid in decision making, use of a moisture tester is advisable under certain circumstances.

### Types of Moisture Testers

Some moisture testers are designed to use a heat source for drying, and a minimum of 20-25 minutes is required before reading results. Moisture testers which use heat to dry (Koster or Dexter<sup>1</sup>) appear to be as effective in determining moisture as the standard method of oven drying. Scientists at the University of Minnesota found that the Koster tester required 20-60 minutes to get an accurate reading depending on the moisture content of the original forage. It is possible to determine the minimum time for drying by weighing at 5 minute intervals, and determining when the sample is no longer losing weight. The point at which weight stabilizes is the minimal time required to get an accurate dry matter reading.

In recent years, testers using electronics to estimate the amount of moisture in a sample have been developed. These electronic testers give an immediate reading. Research in Minnesota compared the electronic moisture testers for accuracy. The most accurate electronic testers without a mechanical packing device tested within 5 percentage units of regular oven drying only 61% of the time. Electronic units utilizing automatic packing devices increased this to 87%, but the electronic units were still inadequate for proper estimation of forage moisture. Research at Michigan State agreed with this conclusion.

### Microwave Oven Procedure

It is possible to use a microwave oven for determination of moisture in forage crops. Canadian workers at the University of Guelph used a microwave with a power of 700 watts and a frequency of 2400 mhz. The following procedure was published:

1. Weigh empty dish.

<sup>1</sup>Trade and brand names are used only for purpose of information and the Virginia Cooperative Extension Service does not guarantee nor warrantee the standard of the product, nor does it imply approval of the product to the exclusion of others which also may be suitable.

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2. Weigh between 50-100 grams (0.1-0.2 pounds) of forage (depending on size of the microwave) that has been chopped into 1-2 inch pieces. An accurate scale is needed for this, and can be obtained at most drugstores.
3. Place chopped forage into the preweighed ovenproof or heat resistant glass or ceramic dish large enough for all the sample to spread into a thin layer to promote even drying.
4. Place the dish with forage into the microwave and heat for about 6 minutes. Remove and reweigh. If forage is not completely dry, replace in oven and heat for another 2 minutes. Reweigh. If in doubt, dry for another 2 minutes and reweigh. If charring has occurred, use the previous weight for calculating moisture.
5. The percent dry matter can be obtained by the following equation:

$$\% \text{ DM} = \frac{\text{weight of forage after drying}}{\text{weight of forage before drying}} \times 100$$

Don't forget to subtract the weight of the dish after each weighing.

### The Squeeze Method

It is possible to estimate the amount of moisture in a forage by squeezing into a ball. If moisture runs out there is over 70% moisture (less than 30% DM) in the forage. If the balls remain together, moisture is between 60-70% (30-40% DM). If the ball opens slowly, there is 50-60% (40-50% DM). A forage containing less than 50% moisture will fall apart. These guidelines are only approximations and should be used in conjunction with actual measurement of moisture, especially if used to balance a ration.

### How to Moisture Test Effectively

The biggest problems in moisture testing are knowing where and how to take a sample. If a representative sample is not obtained, having an accurate estimate of moisture is impossible.

Hay-crop silage: With hay-crop silage (legume and/or grass), the degree of wilting is very important because we normally want to ensile between 35 and 50% dry matter. A sample of forage should be taken from the windrow by taking a 6-inch-wide section from top to bottom of the row. Do not take only the top part because it will normally be drier than that in the middle and bottom. This should be done at several places in the field. After sample collection, samples should be chopped into 1-2 inch lengths, combined, and a portion taken to determine dry matter. Repeat this process several times over a period of time in order to determine the approximate drying rate.

Hay: When making hay, forage should not be raked when it contains more than 65% dry matter or baled when less than 78%. Sample collection and preparation are similar to that for hay-crop silage.

Corn and small grain silages: With the corn plant, the condition of the ear (hard dough) is the best indicator of time of harvest, and dry matter is usually at the desired level. This is also true of barley and wheat (soft dough). A moisture tester allows a double check to see if this is true, especially in drought years. Several plants can be taken from a field and chopped 1-2 inches in length. Make sure that ears or heads, leaves, and stems are all included. A portion of this sample can provide an accurate measure of moisture. During chopping and ensiling it is possible to check the dry matter content over the harvesting period. If dry matter gets out of the desirable range, changes can be made.