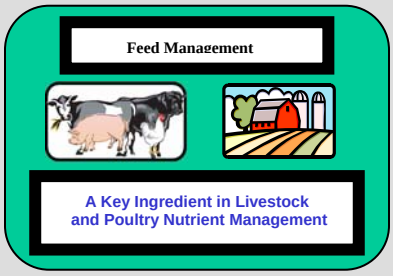

Dry Matter Determination

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Disclaimer
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USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

Introduction

On most animal operations, feed ingredients are provided to animals according to the weight of the feed. Although nutrients in ration formations are often described in terms of a percentage, animals require actual amounts of nutrients. Feeding individual feed ingredients according to weight is only accurate if the moisture content of the feed is the same as it was during the ration formulation period. Changes in the weight of a feed due to changes in moisture alter the nutrient concentrations supplied to the animal if appropriate adjustments are not made to accurately reflect the actual nutrient concentration of the feed ingredient.

Moisture and Dry Matter

In general terms, the weight of a specific feed ingredient comes from either the moisture in the feed or from the dry matter (DM) portion. Dry matter refers to material remaining after removal of water, and the moisture content reflects the amount of water present in the feed ingredient. The nutrients in feeds, required by the animal for maintenance, growth, pregnancy, and lactation, are part of the DM portion of the feed. Knowing the moisture content of a feed ingredient is important because the moisture content affects the weight of the feed, but does not provide nutrient value to the animal. Although animals do have a requirement for water, providing water through an actual water source, instead of through feed ingredients, is necessary.

A variety of factors affect the moisture content of feeds. In many cases, the timing and method of harvest is the largest contributing factor to the moisture content of the feed. However, weather and environmental conditions, such as humidity, rain and snow, all affect feed moisture content. The DM of feeds that are co-products of manufacturing industries are affected by the manufacturing processes themselves and the processing to which they are subjected.

Determining the DM content of feed provides a measure of the amount of a particular feed that is required to supply a set amount of nutrients to the animal. Increases or decreases in feed DM content result in over or under feeding of nutrients.

Dry Matter Determination

Determination of DM is a relatively simple and quick process that can be easily done on a farming operation. The most common way that moisture is determined is through the evaporation of water from the feed, leaving only the dry contents behind. However, there are also electronic methods that have been used to determine the moisture content of feeds.

To accurately determine the DM of a feed, the sample collected must be representative of the feed. The sample size needed to determine DM is dependent on the drying equipment that will be used, and can range from around 100 to 500 g (approximately ¼ to 1 lb). An accurate scale that reads in grams or tenths of an ounce is important to insure accuracy in the calculations.

There are a variety of equipment types that can be used to dry feedstuffs on farm, with each type of equipment having both advantages and disadvantages for use on-farm. Provided below is a brief overview of the common types of drying equipment that can be used on farms.

Forced Air Oven. The most common means used to dry feedstuffs in a laboratory is with a forced-air oven. However, forced air ovens are usually quite expensive compared to other drying equipment, and have greater drying times. Drying time for silage samples is 24 to 48 hours.

Koster Tester. A Koster tester is an electrical appliance that blows heated air through a screen on which the feedstuff is placed. A Koster tester provides a relatively quick and inexpensive means of drying feedstuffs. Some sample loss can occur, which increases the likelihood of errors. Some farms use timers to turn off the Koster tester so that they can do other tasks while the feed dries. It takes about 25 to 50 minutes to dry a sample using this tester.

Microwave. Microwaves provide a relative quick means of drying feedstuffs. The greatest challenge with the use of a microwave is the possibility of burning. Due to the likelihood of burning, samples dried in a microwave should not be submitted to a laboratory for nutrient analyses. The use of a microwave requires constant monitoring. Thus, it is difficult to do other tasks while drying samples in a microwave. Drying time is about 5 to 10 minutes for silage samples.

Vortex Dryer. A vortex dryer is an easy and inexpensive method to dry feedstuffs. Since the sample remains in the enclosed container, there is less chance for losses which will reduce error. Drying times are similar to the Koster tester.

Food Dehydrator. A research trial at the US Dairy Forage Research Center evaluated the use of a food dehydrator with 9 shelves to dry forage samples (Mertens et al., 2004). This method requires minimal operator attention and takes about 2 to 8 hours to determine the DM of silages.

Electronic Methods. Electronic methods are a rapid way to determine DM of feeds. There are a number of devices using this technology on the market. Most of these are designed for use with hay or grain samples. However, at least one tester based on this principle can be used with silage samples. A paper comparing this tester to other DM determination methods has been published (Oetzel et al., 1993). These testers provide a DM reading in < 5 minutes.

Near-Infrared Reflectance Spectroscopy (NIRS). These devices are still in development and not yet available for on-farm use. However, they may be on the market in the next 1 to 2 years. These devices use NIRS and can determine DM in a sample in < 1 minute. The cost of this equipment for on-farm use has not yet been determined. A couple of papers are available that describe some of the early research on using this technology with forages (Cozzolino and Labandera, 2002 and Welle et al., 2003).

Detailed methodology of the use of these various types of equipment can be found in the references listed below.

Calculating Dry Matter

Use the following steps to calculate the dry matter of a feed on farm:

1.) Weigh the empty container selected to hold the feed and record the weight.
2.) Place the feed in the container.
3.) Weigh and record the container and feed weight.
4.) Subtract the weight of the container from the total weight (Step 3) to determine the weight of the feed before drying.
5.) Thoroughly dry the feed.
6.) Weigh and record the container and feed weight immediately after drying.
7.) Subtract the weight of the container from the total weight (Step 6) to determine the weight of the feed after drying.
8.) Divide the weight of the dry feed (Step 4) by the weight of the wet feed (Step 7).
9.) Multiply by 100 to get a percentage.

Example:

Container weight = 300 g
Container and sample weight before drying = 450 g
Wet sample weight = 150 g (Calculation: 450 g – 300 g = 150 g)
Container and sample weight after drying = 354 g
Dry sample weight = 54 g (Calculation: 354 g – 300 g = 54 g)
Dry matter = 36% (Calculation: 54 g/150 g= 0.36 x 100 = 36%)

Summary

Determination of DM in feed is important to insure that animals are receiving the proper amount of nutrients through their diet. A number of options are available for routine on-farm DM determination. Doing routine DM determinations is one more tool to assist in keeping the feeding program on target.

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Project Information

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