



Calculating Dry Matter Intake from Pasture

The Access to Pasture final rule (February 17, 2010) requires that ruminant animals be managed on pasture and graze daily throughout the grazing season. To ensure a pasture-based management system, the rule requires that ruminant animals derive not less than an average of 30 percent of their dry matter intake (DMI) from pasture during the grazing season (grazed from vegetation rooted in pasture or residual forage).

DMI is to be calculated as an average over the entire grazing season for each class and type (stage of production) of animal. The length of the grazing season is determined by the climate patterns and weather events for a geographical location and availability of irrigation. The grazing season must be at least 120 days and does not have to be continuous. This provides flexibility to make adjustments when inclement weather, season, and or climate conditions arise and cause breaks in a continuous grazing period, due to poor growing conditions, for example. There are a variety of acceptable methods for determining dry matter demand and intake that can be readily used by the producer and inspected by the certifying agent. The step-by-step guide, below, presents one method for determining dry matter demand and dry matter intake. This method is commonly used among livestock producers to calculate dry matter demand and dry matter intake, and is shown here in the context of the pasture requirements for organic ruminants. The accompanying NOP DMI Calculation Worksheets can be used to calculate and record dry matter intake. These worksheets can be incorporated into the Organic Systems Plan.

An initial DMI should be calculated at the beginning of the grazing season for each class and type of animal; additional calculations should be made whenever a change occurs. For example, the nutritional requirements of a ruminant animal may vary/change within the grazing season. If a producer wants to maximize the energy expenditure of their animals (e.g., lactation, growth) at a given time, he/she will increase or decrease the DMI to account for the new dry matter demands based on increased/decreased energy needs. To illustrate another example, the diet of an animal may change over the grazing season due to the availability, quantity, and quality of the pasture (forages). Ultimately, a producer will want to show the average of those values over the entire grazing season in the organic system plan.

What is dry matter intake?

Dry matter intake is the amount of feed a cow consumes per day on a moisture-free basis. Most producers are used to dealing with feed on an as-fed basis (pounds of feed actually fed to animal with the water in it); however, in order to determine an accurate estimate of the nutrient intake and to compare feeds, an animal's diet must be analyzed on a moisture-free basis. There are three major factors that can affect a ruminant animal's dry matter intake: feed ration (the quality and availability of forage and the amount and type of supplements); the environment; and the animal itself (including size, body condition, stage of life and level of production).



DMI is a factor that must be estimated before an animal's diet can be properly calculated; it establishes the amount of nutrients available to an animal for health and production. DMI is the level of intake that an animal must consume from a ration that contains the recommended energy concentration for the animal's stage of life and level of production. It is important for DMI to be actually measured or accurately estimated so that diets can be properly formulated to prevent underfeeding or overfeeding of nutrients, and to promote efficient nutrient use.

Estimating daily dry matter intake from pasture is a challenge. Most ruminants eat to satisfy a need for total pounds of dry matter (physical fill) or eat to meet energy needs (energy intake/requirements in response to energy expenditure such as milk production); thus, knowing the predicted dry matter demand will allow you to estimate dry matter intake from pasture. Producers must consider the dry matter demand and nutritional requirements of the class of animal for its given stage of life.

Most producers will predict, or estimate, DMI from reference tables developed for this purpose or published data. Predicting DMI is not an exact science; estimations for dry matter demand and intake do not account for the numerous physiological, environmental, and management factors that alter dry matter demand; therefore, producers should use these values as general estimates. Producers will need to evaluate animals' diets and observe the herd to make sure the animals' nutritional requirements are being met. [Note: See NOP Meeting the Nutritional Requirements (*in development*).] NOP encourages producers to use local, regional, and state experts, such as state Extension Service, Natural Resources and Conservation Service (NRCS) grazing land specialists, university experts, nutritional consultants, and veterinarians to assist in analyzing the numerous physiological, environmental, and management factors specific to your operation that may alter dry matter demand for your animals so that the most accurate DMI can be estimated.

Below is a step-by-step guide on calculating DMI from pasture. Dry matter demand is determined from the expected total DMI as outlined by the National Research Council (NRC) or other published data (Step 1). The amount (dry matter basis) of supplemental feed (such as grain and hay) is determined (STEP 2) and then subtracted from the expected total DMI to "estimate" pasture DMI (Step 3).

Step 1: Predict Dry Matter Demand (in pounds, lb)

The first step in predicting dry matter intake is to estimate dry matter demand. Dry matter demand is the expected dry matter intake for a class of animal. Dry matter demand is generally based on class of animal, stage of life (for example, lactating, reproductive status, or growth stage) and body weight. As stated previously, estimations for dry matter demand do not account for the numerous physiological, environmental, and management factors that alter dry matter demand, and, therefore, should be used as general estimates.



Option 1: Use expected total DMI from referenced tables or published data.

You can determine the pounds (lb) of dry matter demand by using the predicted dry matter intake (DMI) values in the nutrient requirement tables in the Nutrient Requirements of Domestic Animals Series published by NRC. NOP has developed guidance tables adapted from the NRC nutrient requirement tables [*NOP Dry Matter Demand Tables for Classes of Beef Cattle* and *NOP Dry Matter Demand Tables for Classes of Dairy Cattle*]. These documents can be found at www.ams.usda.gov/NOP. The NOP guidance tables are a simplified and condensed version of the information from the NRC nutrient requirement tables. The NRC and NOP tables will give the same or similar values. The NRC publications are accessible online.

- *Nutrient Requirements of Beef Cattle* (7th Revised Edition, 2000, http://www.nap.edu/catalog.php?record_id=9791)
- *Nutrient Requirements of Dairy Cattle* (7th Revised Edition, 2001, http://www.nap.edu/catalog.php?record_id=9825)
- *Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids* (2007, http://www.nap.edu/catalog.php?record_id=11654)

Producers may increase or decrease the dry matter demand value in published data or tables to account for various environment and management factors. If an adjustment is made, the reasons for the adjustment should be documented on the DMI Calculation Worksheet.

EXAMPLE: A 500 lb beef replacement heifer with an expect mature weight of approximately 1,000 lb and an average daily gain of 1.0 lb will have a dry matter demand of 14.6 lb per day.

Option 2: Use a % body weight value to determine dry matter demand for the class of animal.

- 1) Determine the average weight for the class of animal.
- 2) Determine the DMI % Body Weight Value_{for} the class and stage of production of animal.

This can be determined from reference tables or published data. Depending on the quality of diet, breed and size of the animal, and energy expenditure of the animal (pounds of milk produced), a mature beef cow, for example, will consume 1-3% of her body weight, while a mature dairy cow will consume 2.5-4.5% of her body weight.

- 3) Calculate dry matter demand using the following formula:

$$\text{Dry Matter Demand (lb)} = \text{Body Weight (lb)} \times (\text{DMI \% Body Weight Value}/100 \text{ lb})$$



EXAMPLE: Lactating dairy cows weighing an average of 1200 lb will consume approximately 3.0% of their body weight in dry matter intake daily. Thus, the dry matter demand is approximately 36 lb of dry matter per day for that class of animal.

$$\text{Dry Matter Demand (lb)} = 1200 \times (3.0/100) = 36 \text{ lb}$$

Step 2: Determine Dry Matter Intake from Feed Sources Other than Forage Grazed from Pasture (for example, hay and grain)

To do this you will need to know the percent dry matter of the feed source in order to convert the pounds of feed consumed on an as-fed basis to a dry matter basis.

Feed composition information, including dry matter content, is available from the following references/resources:

- Composition of Feeds, Nutrient Requirements of Domestic Animals Series, NRC (links above)
- United States-Canadian Tables of Feed Composition: Nutritional Data for the United States and Canadian Feeds, Third Revision (http://www.nap.edu/catalog.php?record_id=1713)
- Beef Magazine's 2009 Feed Composition Tables – http://beefmagazine.com/nutrition/feed-composition-tables/0301-feed-composition-tables_3/
- Various State Extension Services
- Feed Composition Library, Dairy One (<http://www.dairyone.com/Forage/FeedComp/>)
- Feed Library, The Samuel Roberts Noble Foundation (<http://www.noble.org/Ag/FeedLib/Index.aspx>)

General assumptions for the percent dry matter are as follows:

- Grain = 89% dry matter
- Dry hay = 90% dry matter
- Grain Silage = 25-35% dry matter
- Haylage/Baleage = 35-60% dry matter

Note: If possible, conduct a forage analysis of your feed to determine the actual dry matter content. Use actual dry matter values rather than reference/published values, especially for fresh and ensiled feeds. Fresh and ensiled feeds contain more moisture and therefore can be widely variable. Reference/published values are more accurate for dryer feeds (for example, hay and grain). Using incorrect dry matter values could result in overestimating pasture intake. For more information on forage analysis, see NOP Actual DMI Determination (*in development*).



EXAMPLE:

<u>Feed Source</u>	<u>lb, as-fed</u>	x	<u>Dry Matter, %</u>	=	<u>Lb, dry matter</u>
Hay	5	x	90/100		4.5
<u>Grain</u>	11	x	89/100		<u>9.79</u>
Total lb DMI from Feed Sources other than Pasture =					14.29

Step 3: Determine Dry Matter Intake from Pasture

Option 1: Estimate dry matter intake from pasture by subtracting dry matter intake from other feed sources from the dry matter demand.

EXAMPLE:

Estimated dry matter demand per animal (lb):	36
- total lb DMI from other feed sources	-14.29
= estimated pasture DMI	=21.71 (lb)

Option 2: Determine actual DMI from pasture by field measurements.

Producers may also determine the actual amount of intake from pasture through paddock/field measurements. Guidance for actual pasture measurements can be obtained from local, regional, and state experts mentioned above as well as from NOP Actual DMI Determination (*in development*).

Step 4: Calculate the percentage of dry matter intake to determine if your ruminant animals meet the requirement of 30% dry matter intake from pasture during the grazing season.

% Dry matter intake from pasture = (Estimated lb DMI from pasture divided by (÷) estimated dry matter demand (lb)) x 100

EXAMPLE:

% Dry matter intake from pasture = (21.71 ÷ 36) x 100 = 60.31% (✓ Requirement is met)