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A Greener World Technical Advice Fact Sheet No. 23

Guidance for Calculating Ruminant Feed and Forage Intake

Certified Animal Welfare Approved by A Greener World (AGW) has the most rigorous standards for farm animal welfare currently in use by any organization in North America. Its standards have been developed in collaboration with scientists, veterinarians, researchers and farmers across the globe to maximize practicable, high-welfare farm management.

Ruminants have evolved highly complex digestive systems that enable them to eat and process grass, forage and other cellulose-rich plant materials that we, as humans, cannot digest.

While it is not harmful to feed ruminants small quantities of grain, when they are fed large quantities of grain they can suffer from serious diet- and digestion-related problems such as acidosis (a serious form of bovine heart burn that can lead to diarrhea, ulcers, liver disease and general ill health) and "feedlot bloat".

In addition, feeding ruminants grain is quite inefficient and puts them in direct competition with humans for high-energy crops such as cereals. It has been argued that a more sustainable system is to maximize production from grass and forage (non-human edible feedstuffs) and minimize the use of grains and other feeds that could be used in human food.

Certified Animal Welfare Approved by AGW standards therefore limit the amount of grain that can be fed to ruminants through the following standards:

For beef cattle, non-lactating dairy cattle, meat goats and non-lactating dairy goats, meat sheep and non-lactating dairy sheep and bison:

6.1.1 To ensure proper rumen function cattle/sheep/goats/bison must be provided with 70 percent long fiber roughage/forage in their diet on a daily dry matter basis from weaning onwards.

In other words, these animals can have a maximum of 30 percent of their **daily** dry matter intake (DMI) in the form of grain and other non-forage feeds.

For lactating dairy cattle, dairy sheep and dairy goats:

6.1.2 The minimum requirement for roughage for lactating dairy cows/dairy sheep/dairy goats is 60 percent long fiber roughage/forage on a daily dry matter basis.

In other words, these animals can have a maximum of 40 percent of their **daily** dry matter intake in the form of grain and other non-forage feeds.

This technical paper explains how to calculate the daily dry matter intake of different animals and therefore how much grain they can be fed each day. Remember: the standards above apply for every day of the animals' lives—**not** the total feed over their lifetime.

What is “Dry Matter”?

The Certified Animal Welfare Approved by AGW standards and the calculations below work on dry matter intake. Dry matter is what remains after all of the water is evaporated out of a feed. Different feed sources have different dry matter figures. For example, fresh pasture has a much lower dry matter and higher moisture content than an equivalent weight of dry hay or grain. In order to work out animal intake, compare different feed sources on a like for like basis, and then calculate different diets, we need to work on a dry matter basis. The fresh weight of different feeds can then be derived from these figures (see examples below).

How Do I Calculate Dry Matter Intake?

The daily dry matter intake (DMI) of a particular animal is related to its liveweight, although this will vary slightly depending on the feed type and also the stage of production of the animal. To simplify the calculations Certified Animal Welfare Approved by AGW uses a set figure for different animals as shown below:

Animal Type	Percentage of Body Weight Equivalent to DMI
Beef cattle	2.5 percent
Non-lactating dairy cattle	2.5 percent
Lactating dairy cattle	3.0 percent
Meat goats and meat sheep	3.0 percent
Non-lactating dairy goats and dairy sheep	3.0 percent
Lactating dairy goats and dairy sheep	5.0 percent
Bison	2.5 percent

The daily DMI can be applied to individuals or groups of animals.

Examples of How to Work Out Daily DMI For Different Species

Example 1:

A lactating dairy cow weighs 1,000 lbs. From the table above her total daily DMI is 3.0 percent of her body weight.

$$1,000 \text{ lbs.} \times 0.03 = 30 \text{ lbs.}$$

The cow's total daily DMI is 30 lbs.

Example 2:

A group of 20 ewes are all fed as one group.

They weigh between 130-150 lbs. (with a group average of 140 lbs).

From the table above each ewe's daily DMI is 3.0 percent of her body weight.

$$140 \text{ lbs.} \times 0.03 = 4.2 \text{ lbs.}$$

Each ewe in the group therefore has an average total daily DMI of 4.2 lbs.

What Do I Do With These Daily DMI Figures?

The Certified Animal Welfare Approved by AGW standard requires that most ruminants have a minimum of 70 percent forage in the diet, and that lactating dairy cattle, dairy sheep and dairy goats have a minimum of 60 percent forage in the diet. It is difficult to calculate exactly how much grass, for example, a grazing animal might eat. However, it

is relatively easy to work out how much non-forage food is provided and what proportion of the daily DMI this forms. Once the non-forage food is calculated, anything else the animal eats will be forage.

In other words, rather than working out how much forage the animal needs to eat each day to remain compliant, it is simpler to work out the **maximum** non-forage feed that can be given and ensure the animals are not given more than this each day.

Example 3

A lactating dairy cow weighs 1,000 lbs.

Her daily DMI is $1,000 \times 0.03 = 30$ lbs.

The Certified Animal Welfare Approved by AGW standard requires at least 60 percent of her daily DMI to be forage, and allows a **maximum** 40 percent DMI as non-forage feed like grain.

40% of her 30 lbs. total daily DMI is $30 \times 0.4 = 12$ lbs.

The cow could therefore have 12 lbs. dry matter of non-forage feed per day.

Example 4

A group of 20 ewes weigh on average 140 lbs.

The daily dry matter intake for each ewe is therefore $140 \times 0.03 = 4.2$ lbs.

The Certified Animal Welfare Approved by AGW standard requires at least 70 percent of each ewe's daily DMI to be forage, and allows for a maximum 30 percent DMI as non-forage feed like grain

30 percent of each ewe's 4.2 lb. total daily DMI is $4.2 \times 0.3 = 1.26$ lbs.

The group of 20 ewes could therefore be given $1.26 \times 20 = 25.2$ lbs. dry matter of non-forage feed per day.

How Do I Convert Daily DMI Into Fresh Weight of Feed?

As already mentioned, different feeds have different dry matter values. However, most grains have an average dry matter around 85 percent (the remaining 15 percent being moisture content).

In other words, using Example 3 above, if the 12 lbs. dry matter per day of non-forage feed was given as a mix of grains, the 12 lbs. of mixed grains would represent only 85 percent of the fresh weight of those grains. In other words, more mixed grain could be fed.

Example 5

A 1,000 lbs. lactating dairy cow has a maximum daily DMI of non-forage feed of 12 lbs.

The feed that is used is a mix of grains.

The dry matter content of the mixed grains is approximately 85 percent.

The fresh weight of the maximum amount of grain that can be fed to the cow per day is therefore $12/0.85 = 14.1$ lbs.

Example 6

A group of 20 ewes have a maximum daily DMI of non-forage feed of 1.26 lbs. per ewe (or 25.2 lbs. for the group).

The feed used is a mix of grains.

The dry matter of the mixed grain feed is 85 percent.

The fresh weight of the maximum amount of grain that can be fed per day is therefore $1.26/0.85 = 1.47$ lbs. per ewe per day OR $(1.26/0.85) \times 20 = 29.4$ lbs. for the group per day.

What If I Let the Animals Choose How Much Grain to Eat?

The Certified Animal Welfare Approved by AGW standards apply regardless of whether the farmer feeds a measured amount each day or if the animals have free choice from troughs or other feeders of how much non-forage feed to eat each day.

If a feed hopper is filled less often than daily, the calculations can still be carried out as above. But as well as accounting for the number of animals in the group, the number of days between each fill of the feed hopper with non-forage feed must also be considered.

Example 7

A group of 20 beef finishers are all fed together in one group.

The average weight of the animals is 800 lbs. and their total daily DMI is 20 lbs.

The maximum non-forage feed per day is 30 percent of 20 lbs. = 6 lbs.

The non-forage feed is a sweetmix with a dry matter content of 85 percent.

The maximum fresh weight of sweetmix per animal per day is: $6/0.85 = 7.06$ lbs.

The maximum fresh weight of sweetmix per day for the 20 cattle is: 7.06 lbs. \times 20 = 141.2lbs.

If the feed hopper is only filled once a week the maximum amount of grain that could be given is 141.2 lbs. \times 7 days = 988.4 lbs.

What If My Non-Forage Feeds Aren't Grains?

Various nutritional charts are available online that give dry matter content for a range of feeds. For example, the *Beef Magazine* website ([click here](#)) provides the dry matter content for commonly used feeds, such as:

Cottonseed meal = 90 percent dry matter

Dried brewers grains = 92 percent dry matter

Soybean meal = 90 percent dry matter

Putting it all together

An example of working through from start to finish is shown below:

Example 8

How much grain can I feed a 150 lb. lactating dairy doe and remain within the Certified Animal Welfare Approved by AGW standards?

150 lbs. x 0.05 (5 percent) gives the estimated total daily dry matter intake (DMI) = 7.5 lbs.

7.5 lbs. x 0.4 (40 percent) gives the maximum non-forage DMI = 3.0 lbs.

3.0 lbs. / 0.85 (85 percent) gives the maximum fresh weight grain ration = 3.52 lbs. per day

Charts for Different Species and Weights

The remainder of this technical paper consists of reference tables for different types and weights of animal (DMI = Dry Matter Intake).

CATTLE – EXCEPT FOR LACTATING DAIRY COWS & BISON

Live Weight of Animal	Estimated Total Daily DMI (2.5 percent of live weight)	Maximum Non-Forage daily DMI (30 percent of total DMI)	Maximum Fresh Weight Daily Grain Feed (85 percent DM)
220lb (100kg)	5.5lb (2.5kg)	1.7lb (0.8kg)	1.9lb (0.9kg)
330lb (150kg)	8.3lb (3.8kg)	2.5lb (1.1kg)	2.9lb (1.3kg)
440lb (200kg)	11.0lb (5.0kg)	3.3lb (1.5kg)	3.9lb (1.8kg)
550lb (250kg)	13.8lb (6.4kg)	4.1lb (1.9kg)	4.9lb (2.2kg)
660lb (300kg)	16.5lb (7.5kg)	5.0lb (2.3kg)	5.8lb (2.7kg)
770lb (350kg)	19.3lb (8.8kg)	5.8lb (2.6kg)	6.8lb (3.1kg)
880lb (400kg)	22.0lb (10.0kg)	6.6lb (3.0kg)	7.8lb (3.5kg)
990lb (450kg)	24.8lb (11.3kg)	7.4lb (3.4kg)	8.7lb (4.0kg)
1,100lb (500kg)	27.5lb (12.5kg)	8.3lb (3.8kg)	9.7lb (4.4kg)
1,210lb (550kg)	30.3lb (13.8kg)	9.1lb (4.1kg)	10.7lb (4.9kg)
1,320lb (600kg)	33.0lb (15.0kg)	10.0lb (4.5kg)	11.7lb (5.3kg)
1,430lb (650kg)	35.8lb (16.3kg)	10.7lb (4.9kg)	12.6lb (5.7kg)
1,540lb (700kg)	38.5lb (17.5kg)	11.6lb (5.3kg)	13.6lb (6.2kg)

LACTATING DAIRY COWS

Live Weight of Animal	Estimated Total Daily DMI (3.0 percent of live weight)	Maximum Non-Forage DMI (40 percent of total DMI)	Maximum Fresh Weight Daily Grain feed (85 percent DM)
990lb (450kg)	29.7lb (13.5kg)	11.9lb (5.4kg)	14.0lb (6.4kg)
1,10lb (500kg)	33.0lb (15.0kg)	13.2lb (6.0kg)	15.5lb (7.0kg)
1,210lb (550kg)	36.3lb (16.5kg)	14.5lb (6.6kg)	17.0lb (7.8kg)
1,320lb (600kg)	39.6lb (18.0kg)	15.8lb (7.2kg)	18.6lb (8.5kg)
1,430lb (650kg)	42.9lb (19.5kg)	17.2lb (7.8kg)	20.2lb (9.2kg)
1,540lb (700kg)	46.2lb (21.0kg)	18.5lb (8.4kg)	21.7lb (9.9kg)
1,650lb (750kg)	49.5lb (22.5kg)	19.8lb (9.0kg)	23.3lb (10.6kg)

MEAT SHEEP AND NON-LACTATING DAIRY SHEEP

Live weight of animal	Estimated Total Daily DMI (3 percent of live weight)	Maximum Non-Forage DMI (30 percent of total DMI)	Maximum Fresh Weight Daily Grain Feed (85 percent DM)
66lb (30kg)	2.0lb (0.9kg)	0.6lb (0.3kg)	0.7lb (0.32kg)
88lb (40kg)	2.6lb (1.2kg)	0.8lb (0.4kg)	0.9lb (0.4kg)
110lb (50kg)	3.3lb (1.5kg)	1.0lb (0.45kg)	1.2lb (0.5kg)
132lb (60kg)	4.0lb (1.8kg)	1.2lb (0.5kg)	1.4lb (0.6kg)
154lb (70kg)	4.6lb (2.1kg)	1.4lb (0.6kg)	1.6lb (0.7kg)
176lb (80kg)	5.3lb (2.4kg)	1.6lb (0.7kg)	1.9lb (0.9kg)
198lb (90kg)	6.0lb (2.7kg)	1.8lb (0.8kg)	2.1lb (1.0kg)

LACTATING DAIRY SHEEP

Live weight of animal	Estimated Total Daily DMI (5 percent of live weight)	Maximum Non-Forage DMI (40 percent of total DMI)	Maximum Fresh Weight Daily Grain Feed (85 percent DM)
66lb (30kg)	3.3lb (1.5kg)	1.32lb (0.6kg)	1.55lb (0.70kg)
88lb (40kg)	4.4lb (2.0kg)	1.76lb (0.8kg)	2.07lb (0.94kg)
110lb (50kg)	5.5lb (2.5kg)	2.2lb (1.0kg)	2.58lb (1.18kg)
132lb (60kg)	6.6lb (3.0kg)	2.64lb (1.2kg)	3.10lb (1.41kg)
154lb (70kg)	7.7lb (3.5kg)	3.08lb (1.4kg)	3.62lb (1.64kg)
176lb (80kg)	8.8lb (4.0kg)	3.52lb (1.6kg)	4.14lb (1.88kg)
198lb (90kg)	9.9lb (4.5kg)	3.96lb (1.8kg)	4.66b (2.11kg)

MEAT GOATS AND NON-LACTATING DAIRY GOATS

Live weight of animal	Estimated Total Daily DMI (3 percent of live weight)	Maximum Non-Forage DMI (30 percent of total DMI)	Maximum Fresh Weight Daily Grain Feed (85 percent DM)
66lb (30kg)	2.0lb (0.9kg)	0.6lb (0.3kg)	0.7lb (0.32kg)
88lb (40kg)	2.6lb (1.2kg)	0.8lb (0.4kg)	0.9lb (0.4kg)
110lb (50kg)	3.3lb (1.5kg)	1.0lb (0.45kg)	1.2lb (0.5kg)
132lb (60kg)	4.0lb (1.8kg)	1.2lb (0.5kg)	1.4lb (0.6kg)
154lb (70kg)	4.6lb (2.1kg)	1.4lb (0.6kg)	1.6lb (0.7kg)
176lb (80kg)	5.3lb (2.4kg)	1.6lb (0.7kg)	1.9lb (0.9kg)
198lb (90kg)	6.0lb (2.7kg)	1.8lb (0.8kg)	2.1lb (1.0kg)

LACTATING DAIRY GOATS

Live weight of animal	Estimated Total Daily DMI (5 percent of live weight)	Maximum Non-Forage DMI (40 percent of total DMI)	Maximum Fresh Weight Daily Grain Feed (85 percent DM)
66lb (30kg)	3.3lb (1.5kg)	1.32lb (0.6kg)	1.55lb (0.70kg)
88lb (40kg)	4.4lb (2.0kg)	1.76lb (0.8kg)	2.07lb (0.94kg)
110lb (50kg)	5.5lb (2.5kg)	2.2lb (1.0kg)	2.58lb (1.18kg)
132lb (60kg)	6.6lb (3.0kg)	2.64lb (1.2kg)	3.10lb (1.41kg)
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198lb (90kg)	9.9lb (4.5kg)	3.96lb (1.8kg)	4.66lb (2.11kg)

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Guidance for Calculating Ruminant Feed and Forage Intake is one of A Greener World's Technical Advice Fact Sheet range, designed to provide practical advice and support to farmers and ranchers. For more information, visit agreenerworld.org.

KEYWORDS

Ruminant; dry matter; daily dry matter intake; fresh weight; forage; reference table.