PNW 259 / Revised April 1999

Valuing Forages Based on Moisture and Nutrient Content

T. Downing and M. Gamroth

Knowing the moisture content of forage assures the buyer of its nutritional value and the seller of its fair market value.

High-quality forages, such as alfalfa and grasses, are important for efficient milk production from dairy cows. Forages provide the effective fiber that is critical for good health and longevity. Inadequate effective fiber in the cow's diet is one reason for acidosis and milk fat depression.

Historically, when forage quality changed, dairy farmers adjusted the forage-to-concentrate ratio to compensate for reductions in energy and protein availability. As cows continue to produce more milk, this flexibility has been drastically reduced, further emphasizing the need to include only the highest quality forages in lactating cows' diets.

This need for high-quality forages places a premium value on these commodities in the marketplace. As with all markets, the rules of supply and demand drive the prices of high-quality forages.

The objectives of this publication are to calculate the cost of home-grown forages and to attempt to value these forages against the costs of purchasing high-quality forages.

Revised by Troy Downing, Extension dairy agent, and Mike Gamroth, Extension dairy specialist, Oregon State University. Originally prepared by Gary L. Schneider, Extension agent (dairy), Malheur County, and Michael J. Gamroth, Extension dairy specialist, Oregon State University. This publication prepared in cooperation with Extension specialists at the University of Idaho and Washington State University.

A Pacific Northwest Extension Publication
Oregon • Idaho • Washington

Determining forage production costs

Collecting the necessary data to make good decisions is critical when evaluating the costs and relative values of forages. You need data on planting costs, maintenance costs, harvest costs, and losses during storage and feeding. Tables 1 and 2 will help you work through these costs. At times, estimates are the best numbers available; use them until you have better numbers. The same approach can be used for valuing alfalfa.

Comparing your costs to alternative feeds

Only when you compare your forage production costs to alternatives can you make educated decisions on whether to grow or buy forages. Moisture content, crude protein, and fiber (acid detergent and neutral detergent fiber) content also are important when comparing home-grown forages to alternatives.

One easy comparison is between the cost of your home-grown forages and the cost of dry hay available to purchase in your area. Table 3 compares the dry matter content of various feeds to that of hay and converts each to a relative dry matter value. For example, if you direct cut green chop at 25 percent dry matter, multiply the current price of hay by 0.277 to get the value of your green chop. Example: Assume a stored hay price of $70.00 per ton and a 30 percent dry-matter silage, which has a relative value of 0.333.

$70.00/ton hay x 0.333 = $23.31/ton value of silage

Now you can compare values in two ways:

- If it costs more than $23.31/ton to produce your grass silage, you're better off buying the stored hay.
- If you can produce silage for $23.31 at 30 percent dry matter, you can afford to purchase hay only if it costs less than $70.00/ton.

Table 1.—Typical per-acre costs of establishing grass for silage.

Item	Price	Units	$/acre	Your farm
Planting				
—plowing	$40/hr	1 hr	40.00	_____
—discing 2x	$40/hr	1.5 hr	60.00	_____
—seeding	$30/hr	1 hr	30.00	_____
—fertilizer	$240/ton	250 lb	30.00	_____
—fert. application	$15/acre	1 acre	15.00	_____
—seed	$1.50/lb	25 lb	37.50	_____
—management	$10/acre	1 acre	10.00	_____
Establishment totals			**$222.50/acre**	_____
Prorated costs (5 years with 10% annual interest on $222.50 investment)			**$58.00/acre/yr**	_____

Table 2.—Typical per-acre annual production and harvest costs for grass silage.

Item	Price	Units	$/acre	Your farm
Prorated establishment (from Table 1)			58.00	_____
Land ownership cost	$150/acre	1 acre	150.00	_____
Mower	$30/hr	0.5 hr	15.00	_____
Chopper	$40/hr	0.75 hr	30.00	_____
Truck	$25/hr	0.75 hr	18.80	_____
Bagger	$25/hr	0.75 hr	18.80	_____
Bag storage site preparation	$100/bag	bag/12 acres	8.70	_____
Bag	$225/bag	bag/12 acres	25.50	_____
Total annual costs/acre			**$324.80**	_____
Total costs per ton bagged (15 tons silage @ 33% dry matter)			**$21.70/ton**	_____

Table 3.—Relative values of forages with different dry-matter contents.

Feed	% dry matter	Relative value (stored hay = 1)
Stored hay	90	1.000
Freshly baled hay	84	0.933
Wilted silage	40	0.444
	35	0.388
	30	0.333
Direct cut silage or green chop	25	0.277
	20	0.222

Figure 1.—After you place your forage in the bag, weigh it again.

Figure 2.—Dry your sample for 3 minutes, medium power setting.

Determining moisture content

It's important to test a sample of the crop you're pricing for dry matter. A little moist feed will improve animal intake, but don't pay for moisture you don't need. A few quick tests and calculations will keep forage producers and users happy with their farms' production.

Collect several samples to help overcome the variation in moisture within a truckload. Collect and transport samples in airtight plastic containers.

Buyer and seller should agree on the sampling, testing, and pricing methods. The two parties also should agree on who will pay for testing.

Many commercial feed-testing laboratories will rush the results of a moisture test if requested. They'll send nutritional analyses of the same samples later. Your Extension agent can provide a list of forage testing labs.

You can do quick moisture analyses with a good scale and a microwave oven. A small dietetic or kitchen scale that weighs in grams will serve your weighing needs. They sell for $25–$30.

For green chop, haylage, or silage, follow this procedure:

1. Weigh a paper bag large enough to hold 4 ounces of your forage. Write down the weight as value "A."
2. Place about 4 ounces, or 100 grams, of your forage in the paper bag and weigh again. Write this down as value "B."
3. Place a cup of water in the corner of the oven. Begin drying the sample with the medium power setting of the oven. Dry for 3 minutes, remove the sample, and stir gently. Dry for another 1½ minutes, stir, and dry for 1 minute.
4. The sample should be getting dry and crisp. Weigh the sample and bag, stir again gently, and dry for 30 seconds. Continue the 30-second drying and weighing until the weight doesn't change. If the sample begins to char, use the last weight. Record the final weight as "C."
5. Calculate the dry matter content using this formula:

Figure 3.—Weigh your sample again. Repeat the drying and weighing until your sample's weight doesn't change.

$$\text{\% Dry matter content} = \frac{\text{Total dry weight "C" minus bag weight "A"}}{\text{Total wet weight "B" minus bag weight "A"}} \times 100$$

Example: the container bag weighs 25 grams, the wet forage is 100 grams (total wet weight of 125 grams), and the final dry weight turns out to be 45 grams total with bag:

$$\text{\% DM} = \frac{\text{45 grams (total dry weight "C") - 25 grams (bag weight "A")}}{\text{125 grams (total wet weight "B") - 25 grams (bag weight "A")}} \times 100$$

% DM = 20 grams (45 g - 25 g) divided by 100 grams (125 g - 25 g) x 100

% DM = 0.2 x 100 = 20%

Experiment with drying times before running an "official" sample. Some ovens don't heat uniformly. Dry the sample in different places in the oven. Some discoloration is normal, but blackened forage indicates you have burned off some of the dry matter.

Estimating storage losses

It also is important to consider storage losses when you price forages. Dry matter content at harvest directly affects dry matter losses during storage. Figure 4 illustrates that hay dried in the field undergoes large dry matter losses before baling, whereas forages with higher moisture content have higher losses during storage.

A final comparison

You can more accurately determine values of your forages by including crude protein as a quality measure and by adjusting for expected storage losses. Table 4 accounts for moisture, crude protein, and storage losses of silage.

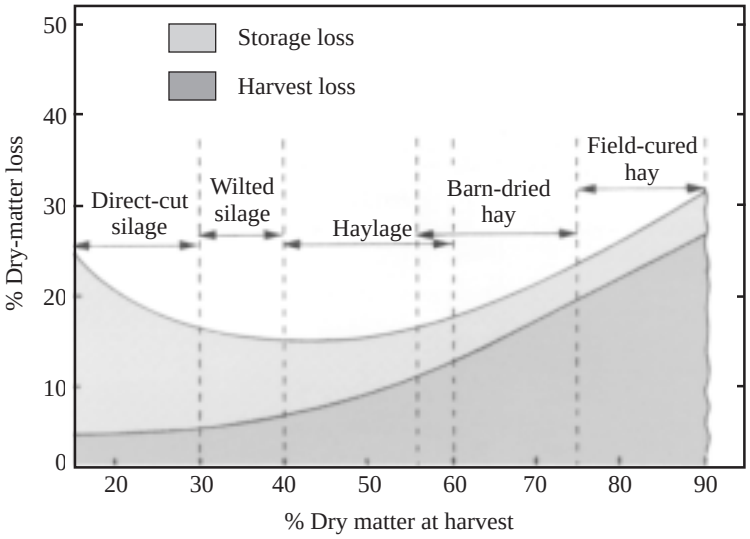

Figure 4.—Estimated total field and harvest loss and storage loss when legume-grass forages are harvested by varying methods and at varying moisture levels.

Table 4.—Comparing forage values.

	Example	Your farm
1. Market price of reference hay	$150.00	_____
2. Dry matter of reference hay	90%	_____
3. Crude protein of reference hay	22%	_____
4. Dry matter of forage you want to price	33%	_____
5. Crude protein of forage you want to price	16%	_____
6. Divide line 4 by line 2	0.4	_____
7. Divide line 5 by line 3	0.73	_____
8. Multiply line 7 times line 6	0.29	_____
9. Multiple line 8 times line 1	$43.50	_____
10. Estimated loss in storage	20%	_____
11. Subtract line 10 from 100%	80%	_____
12. Multiply line 9 times line 11	$34.80	_____

Line 12 represents the value of your forage compared to commercially available forage. It is important to remember we adjusted for only moisture, crude protein, and storage loss.

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Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Oregon State University Extension Service, Washington State University Cooperative Extension, the University of Idaho Cooperative Extension System, and the U.S. Department of Agriculture cooperating.

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