Forage Value

2

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Livestock producers in the western United States, including Oregon, are at an economic disadvantage relative to those in some other regions in North America because of relatively high winter feed costs. A ruminant animal consumes on average 2 to 3 percent of its body weight in dry matter each day. This equates to feeding 1.5 to 2.5 tons of conserved forage to mature cows or 0.25 to 0.5 ton to ewes during the winter feeding period. This volume of feed can represent more than 50 percent of the producer's input costs. The ability of Oregon cattle producers to compete with other regions of North America may relate to how effectively they can reduce winter feed costs while maintaining acceptable levels of beef cattle production.

In the grazing season, vegetative forage with an available height of 4 to 8 inches usually provides the nutritional needs of livestock. Outside of the grazing season, however, livestock depend on the producer to provide for their nutritional needs. It is during this period, when animals are fed conserved forage, that the nutritional management program plays an important part in maintaining the growth and condition of livestock.

In order to provide a ration that meets the nutritional needs of livestock, it is necessary to know the nutritive value of the forage. Forage value, whether hay or pasture, differs depending largely on stage of maturity, time, and weather at harvest.

Vegetative growth is the leafy growth that occurs in the early and middle parts of the growing season, and it is the most nutritious forage. Reproductive growth is the seed-producing stage of growth. It occurs later in the growing season, is a characteristic of mature plants, and is of reduced nutritive value.

Even if forage is harvested at the proper time, the nutrient content of the resulting hay or silage can vary widely. The amount and type of fertilizer used and the composition of the stand can contribute to variability.

Accurate forage analysis (see Chapter 3) is critical to profitable winter, nonpasture feeding programs. Even small deficiencies in protein and energy can lead to lower-than-desired performance levels of animals.

Once you determine the nutritive quality of the forage, you can decide how to allocate the feed. Ideally, you would formulate a complete and balanced ration, possibly including supplemental protein and/or energy (see Chapter 5). Alternatively, you could allocate the best quality feed to the animals with the highest nutrient requirements (see Chapter 1) and the lowest quality feed to those with lower requirements. The goal would be to use the feed in the most nutritionally appropriate manner.

Estimated and measured values

You can obtain a rough estimate of the value of forages through visual assessment, tables in nutrition books, and Extension publications. However, laboratory testing of your specific forage will provide the most accurate values for balancing livestock rations.

Once value has been determined, use the information to help provide balanced rations for your livestock. It can help you determine what supplements you need to add or simply the best way to use the feed you have.

Visual assessment

Several visual factors can assist in evaluating the nutrient value or quality of conserved forages. These factors are as follows.

Maturity. Maturity can be determined by observing bloom or bud stage and stem size. More abundant blooms or mature seed heads, fewer buds, and larger, woody stems indicate more mature forage.

Leafiness. Approximately two-thirds of the protein in forage is in the leaves. The ratio of leaves to stems is more important with legume forages than with grass forages.

Color. Forage that is not bright green may be damaged. Rain bleaches forage, heavy rain causes a dark brown or black color, and heat or fermentation causes browning. Yellowing can indicate overly mature forage.

Presence of foreign material. Weeds, chaff, sticks, and other matter that is not forage indicate lower quality hay.

Odor and condition. Hay that smells musty or is moldy indicates rain damage or baling at too high a moisture content. The result is lower quality hay and lower intake by animals.

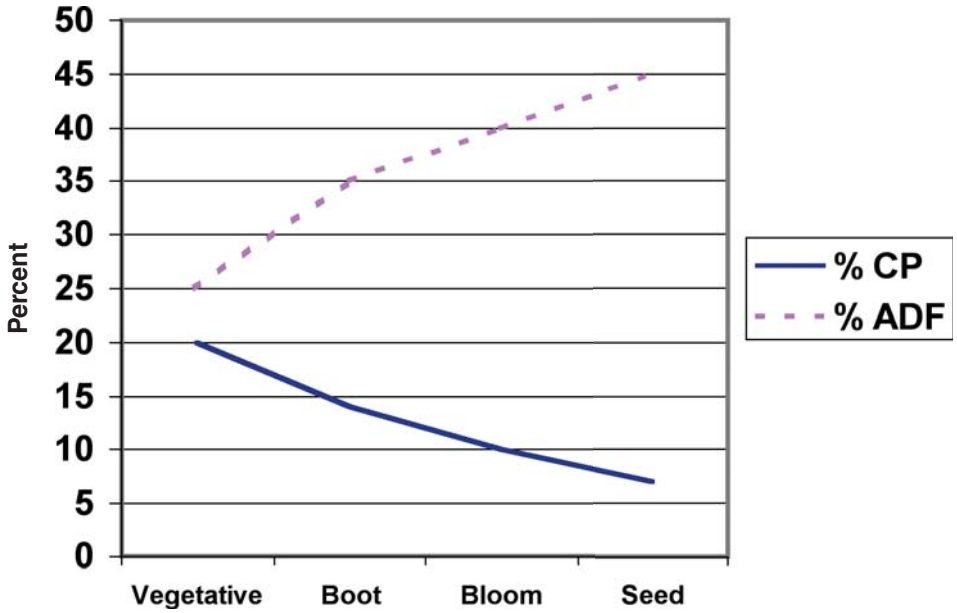

Figure 2.1—Change in crude protein (CP) and acid detergent fiber (ADF) with increasing maturity of cool-season grass forage based on laboratory tests in Oregon.

Maturity of the forage is one of the most important factors that determine proper harvest time. As forage plants or hays mature, the quality or feed value declines. As can be seen in Figure 2.1, the crude protein content decreases as the forage moves from a vegetative stage to seed head production. Additionally, the acid detergent fiber, which is an estimated measure of digestibility, increases during the same period. Increased acid detergent fiber means lower digestibility.

These changes in nutritional quality occur anytime during the growing season when plants move from a vegetative to a mature stage of production. During the most mature stage of plant growth (seed), protein and energy levels are too low to meet the nutrient requirements of most classes of livestock (see Chapter 1). Supplemental protein would be needed in order for livestock to utilize this very mature forage. Supplemental energy also might be needed, depending on animal requirements.

Table 2.1 shows data from a 6-year study in Washington, in which samples of perennial and annual ryegrass were harvested at different stages of maturity over an entire growing season. An example of the nutritional value for the boot, early boot, and vegetative growth stages is listed. Vegetative samples show much higher crude protein than the boot stage of growth. The early boot stage of grasses is considered to be the ideal cutting time to capture the highest yield and quality of a pasture or hayfield.

Stockpiled forage is pasture that was managed so as to keep the forage in the vegetative stage through the end of the growing season. As a result, the forage does not decrease in quality to the same extent as forage that is allowed to mature into the reproductive stage of growth. This standing forage is then utilized at a later date.

This practice works well in the dry climates of central and eastern Oregon, but on the west side of the Cascades the forage must be grazed before much rainfall accumulates. Rain reduces the value and desirability of the forage. Vegetative stockpiled forage is best utilized by about November 15 in western Oregon. The quality of this forage usually is intermediate relative to green, vegetative growth and dry, mature forage. Supplementation of animal diets may be required.

Table 2.1. Growth stage differences in nutritional quality (crude protein) of annual and perennial ryegrass in western Washington (average over a 6-year period).

	Crude protein (%)		
Cutting	Annual ryegrass	Perennial ryegrass	Growth stage[a]
1	9.75	10.56	Boot
2	15.56	16.94	Early boot
3	20.56	20.75	Vegetative
4	22.94	24.00	Vegetative
5	23.19	30.25	Vegetative

[a]The last three cuttings (vegetative growth) were taken during the summer and fall.

Book values and Extension publications

It has long been recognized that book value nutrient analyses for forages grown in other parts of the country do not accurately represent Oregon forages. To formulate winter beef diets, analyses for Oregon-produced forages are needed.

In order to develop a database of Oregon forages, more than 30 forages grown in Oregon were analyzed by Oregon State University researchers. These forages were evaluated for protein, energy, fat, fiber, and mineral content. In addition, the OSU research team compiled dry matter, crude protein, and acid detergent fiber results from hay surveys of more than 400 forage samples to create the Oregon Forage and Byproduct Library (see references). Mineral analyses are also included in the Library tables. There also is nutritional information on by-products as livestock feeds. This library is a valuable source of information to help producers estimate the nutritional value of locally produced or purchased forages.

Table 2.2 at the end of this chapter shows the nutrient content of common feeds used as protein and energy supplements.

Laboratory analysis

Ideally, you should have your forage tested each year for dry matter, crude protein, and acid detergent fiber (see Chapter 3). Laboratory analysis is by far the best way to develop your winter feeding program. Compare your forage analysis with the tables in the Oregon Forage and Byproduct Library and use the estimates of energy for beef cattle (TDN) and the other analyses to formulate your rations.

References

Cow–Calf Management Guide and Cattle Producer's Library. Agricultural Communications, College of Agricultural and Life Sciences, University of Idaho, Moscow, ID 83844-2332. Phone: 208-885-7839. Web: http://WBRC.ag.uidaho.edu/

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Oregon Forage and Byproduct Library, Oregon State University, 112 Withycombe Hall, Corvallis, OR 97331-6702. Phone: 541-737-3431. Web: http://osu.orst.edu/dept/animal-sciences/foraglib.htm

Worksheet 2.1
Characterizing Your Forage Quality

What kind of conserved forage (hay, balage, or standing grass and/or legume mix) do you feed?

_____

_____

What was the stage of maturity when harvested?_____

_____

What is your estimate of the crude protein and energy content of your conserved forage?

_____

_____

Describe your conserved forage in relation to the following factors: maturity, leafiness, color, foreign material, odor, and condition. _____

_____

_____

_____

Do you have your conserved forage analyzed? _____

What is the lab analysis of your feed? CP_____TDN_____Other, if known _____

_____

_____

Table 2.2. Nutrient composition of common feedstuffs and range plants.[a]

Feedstuff	Dry matter (%)	TDN (%)	CP (%)	Ca (%)	P (lb)
Grazed plants					
Brome, fresh, early vegetative	34	74	18	0.50	0.30
Dropseed, sand, fresh, stem-cured	88	59	5	0.57	0.06
Galleta, fresh, stem-cured	71	48	5.5	1.05	0.07
Needle and thread grass, fresh, stem-cured	92	49	4.4	1.09	0.06
Orchardgrass, fresh, early vegetative	23	72	18.4	0.58	0.54
Orchardgrass, fresh, midbloom	31	57	11	0.23	0.23
Redtop, fresh	29	63	11.6	0.46	0.29
Ryegrass, fresh	27	68	10.4	0.55	0.27
Sage, black, browse, fresh, stem-cured	65	49	8.5	0.81	0.17
Sagebrush, big, browse, fresh, stem-cured	65	50	9.3	0.71	0.18
Sagebrush, bud, browse, fresh, late vegetative	32	52	17.5	0.60	0.42
Saltbush, browse, fresh, stem-cured	55	36	7.2	2.21	0.12
Saltgrass, fresh, post ripe	74	53	4.2	0.23	0.07
Squirreltail, fresh, stem-cured	50	50	3.1	0.37	0.06
Summer cypress (kochia), fresh, stem-cured	85	50	9	2.36	0.12
Timothy, fresh, late vegetative	26	72	18	0.39	0.32
Timothy, fresh, midbloom	29	63	9	0.80	0.30
Wheatgrass, crested, fresh, early vegetative	28	75	21.5	0.46	0.34
Wheatgrass, crested, fresh, full bloom	45	61	9.8	0.39	0.28
Wheatgrass, crested, fresh, post ripe	80	49	3.1	0.27	0.07
Winterfat, fresh, stem-cured	80	35	10.8	1.98	0.12
Other roughage					
Alfalfa hay, early bloom	90	60	18	1.41	0.22
Alfalfa hay, midbloom	90	58	17	1.41	0.24
Alfalfa hay, late bloom	90	52	14	1.43	0.25
Alfalfa hay, mature	91	50	12.9	1.13	0.18
Barley straw	91	40	4.3	0.30	0.07
Brome hay, sun-cured, late vegetative	88	60	16	0.32	0.37
Brome hay, sun-cured, late bloom	89	55	10	0.30	0.35
Corn, silage	33	68	8.1	0.23	0.22
Fescue hay, sun-cured, early vegetative	91	61	12.4	0.51	0.36
Fescue hay, sun-cured, late vegetative	92	48	9.5	0.30	0.26
Oat hay	91	55	9.3	0.24	0.22
Oat straw	92	45	4.4	0.24	0.06
Orchardgrass, hay, sun-cured, late bloom	91	54	8.4	0.26	0.30
Redtop, hay, sun-cured, midbloom	94	57	11.7	0.63	0.35

[a]TDN = total digestible nutrients; CP = crude protein; Ca = Calcium; P = Phosphorus

Table 2.2. Nutrient composition of common feedstuffs and range plants.[a]

Feedstuff	Dry matter (%)	TDN (%)	CP (%)	Ca (%)	P (lb)
Other roughage (continued)					
Ryegrass, hay, sun-cured, midbloom	86	60	8.6	0.65	0.32
Sedge hay, sun-cured	89	52	9.4	—	—
Sweetclover, yellow, hay, sun-cured, midbloom	87	54	15.7	1.27	0.25
Timothy hay, sun-cured, full bloom	89	56	8.1	0.43	0.20
Wheatgrass, crested, hay, sun-cured	93	53	12.4	0.33	0.21
Wheat hay	88	58	8.5	0.15	0.39
Wheat straw	89	41	3.6	0.18	0.05
Concentrates (protein and energy)					
Barley	88	84	13.5	0.05	0.38
Beet molasses	78	79	8.5	0.17	0.03
Brewers grains	92	66	28.1	0.29	0.54
Corn	88	90	10	0.02	0.35
Cottonseed meal	91	76	45.2	0.22	1.21
Milo	89	80	12.4	0.04	0.33
Oats	89	77	13.3	0.07	0.38
Soybean meal, 44%	90	85	47.7	0.29	0.68
Wheat	89	88	16	0.04	0.42
Wheat middlings	89	69	18	0.18	0.99

Source: Adapted from National Research Council. 1984. *Nutrient Requirements of Beef Cattle.* National Academies Press, Washington, DC.