Forage quality key with high-priced corn

Bottom Line

with
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THE nearby corn grain price on the Chicago Board of Trade has escalated another $11 per ton since the end of November. That's an increase of about $53 per ton since the end of September. The quality of forage becomes more valuable as corn and protein prices increase. We need to maximize forage use and minimize corn and protein concentrate use.

Broderick (2003) fed high, medium and low levels of neutral detergent fiber (NDF), each at three levels of crude protein (CP), to 45 multiparous and 18 primaparous cows. The forage portion of the ration was about 60% alfalfa and 40% corn silage on a dry matter basis.

The high-NDF ration (36% NDF) had 75% forage, the medium-NDF ration (32% NDF) had about 62% forage and the low-NDF ration (28% NDF) had 50% forage (Table 1). The corn silage used was 38.5% NDF (very low for California standards), and the alfalfa silage averaged 41.5%, indicating that it was high-NDF according to California standards. If the alfalfa silage contained only 33% NDF as is typical of good California hay, the high NDF treatment would have had only 31.8% NDF, the medium 28.5% and the low 25.2%.

This illustrates the huge effect forage quality has on the amount of corn grain required in the ration. The high, medium and low protein levels were 18.4, 16.7 and 15.1% CP.

Fat-corrected milk (3.5% FCM) was similar for the medium- and low-level NDF rations, but the high-NDF ration supported about 3.5 lb. less 3.5% FCM per cow per day (Table 2). Feed efficiency (pounds of 3.5% FCM per pound of dry matter consumed) followed a similar pattern as FCM.

The 10% extra rolled high-moisture shelled corn in the low-NDF ration did not result in more milk production than the medium-NDF ration. Milk production was similar for the medium- and high-CP rations and higher than for the low-CP ration (Table 3). Feed efficiency was similar for the low- and medium-CP rations and higher than the high-CP ration.

It probably costs very little more per ton of silage to produce excellent corn silage as opposed to average corn silage. A dairy producer buying corn silage usually pays the same price per ton for varying qualities of corn silage if they have the same dry matter. The difference in value of corn silage can be considerable.

The variation in NDF, non-fiber carbohydrate (NFC), NDF digestibility and total dry matter digestibility among corn silages I tested this year is shown in Table 4. The NFC percentages of these silages ranged from 43 to 31%. Rations using the high-NFC corn require about 1.5 lb. less corn grain than rations using the low-NFC corn silage for the same energy level.

At a price of $194 per ton, the high-NFC silage is worth about $4.30 more per ton than the low-NFC silage.

Some hybrids have been selected for improved NDF digestibility. NDF of brown midrib hybrids (BMR) is usually about 7.5-10% higher than the average regular hybrid. A combination of high-NFC yield and NDF digestibility can easily make one silage hybrid worth 15% — maybe 20% — more than another.

Early planting and hybrid selection are the main factors determining NFC content. John Quillen, an agronomist who has worked with seed companies in California for many years, said corn planted after May 1 yields about 50-100 lb. less grain per acre per day than corn planted earlier than May 1. Corn planted June 1 in California may yield about 3,000 lb. less grain per acre than corn planted May 1. Similar yield patterns occur in the Midwest also.

New selections of BMR silages contain about as much NFC and starch as the better regular hybrids, so they allow for the

1. Ration composition (Broderick, 2003)

NDF[1]	High			Med			Low		
CP[2]	Low	Med	High	Low	Med	High	Low	Med	High
	% of dry matter								
Alfalfa silage	43.8	43.8	43.8	37.3	37.3	37.3	30.8	30.8	30.8
Corn silage	30.9	30.9	30.9	25.3	25.3	25.3	19.3	19.3	19.3
Rolled high-moisture corn	21.5	17.1	12.6	31.4	27	22.5	41.7	37.3	32.8
Roasted soybeans	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Soybean meal	1.0	5.3	9.8	2.9	7.3	11.8	4.8	9.3	13.7
Sodium bicarbonate	0.0	0.0	0.0	0.25	0.25	0.25	0.5	0.5	0.5
Mineral/vitamin	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Chemical composition									
CP	15.1	16.7	18.5	15.2	16.7	18.4	15.1	16.6	18.3
NDF	36.4	35.0	35.1	31.2	31.7	32.6	28.3	27.9	27.6
ADF	24.3	23.7	23.8	21.4	21.6	22.4	19.2	18.6	19.1
NFC	37.5	37.8	35.9	43.4	41.3	39.3	46.8	46.0	44.5

[1]NDF on a dry matter basis, high = 36%, med = 32% and low = 28%.
[2]CP on a dry matter basis, low = 15.2%, med = 16.7% and high = 18.4%.

2. Effect of CP on milk production (Broderick)

	CP as % dry matter			Std.
	15.1	16.7	18.4	error
Dry matter intake, lb. per day	46.6[c]	48.6[b]	49.7[a]	0.3
Bodyweight gain, lb. per day	1.0	1.25	1.2	0.08
Milk, lb. per day	72.6[b]	75.0[a]	75.0[a]	0.6
3.5% FCM, lb. per day	72.8[b]	76.1[a]	75.5[a]	0.6
Milk fat, %	3.51	3.66	3.6	0.07
Milk protein, %	2.99[b]	3.03[a]	3.02[a]	0.03
Efficiency				
FCM/dry matter intake	1.56[a]	1.56[a]	1.52[b]	0.02
Milk nitrogen per nitrogen intake	0.303[a]	0.27[b]	0.239[c]	0.004
Milk urea nitrogen, mg/dl	9.2[c]	12.4[b]	15.9[a]	0.2

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most reduction in corn grain in the ration. The amount of increase in milk production from BMR silage depends on the quality of regular silage against which it is compared.

There is a yield penalty as alfalfa is cut in shorter intervals to improve quality (Tables 5 and 6).

Currently, in the central San Joaquin Valley of California, the U.S. Department of Agriculture market news reported the following prices delivered to the dairy: supreme grade, $191.50; premium, $177.72; good, $166.42, and fair, $148.42.

A least-cost comparison with nutritional minimums for 100 lb. milk production justifies only a $4 spread between the supreme and good quality grades. Due to the improvement in dry matter intake, increased milk production and improved feed efficiency with premium-grade hay over good-quality hay, about an $8-10 difference could be justified. A feeding rate of one-third premium and two-thirds good would be optimum.

California alfalfa hay pricing is based on acid detergent fiber (ADF) values, which are less accurate at predicting performance than nutrient value predictions based on NDF. Probably the best alfalfa hay prediction equation for nutritional value is relative forage quality based on CP, NFC, NDF, NDF digestibility and ether extract.

The dry matter, dry matter digestibility, NDF, NFC and CP of all forages fed should be known. In addition, NDF digestibility, lignin, starch and ash give useful information to make optimum reductions in expensive corn grain without harming production and reproduction. A certified forage lab should be used to get good results.

The Bottom Line

High concentrate costs are forcing maximum utilization of forages. We may be pleasantly surprised at the level of production attainable with reduced corn and protein supplement feeding if the forage is high quality. Production response is more rapidly evident than breeding response. Care must be taken not to jeopardize conception rates with inadequate energy in the ration. Dairy nutritionists are getting a workout now, and they can provide a valuable service.

3. Effect of NDF on milk production (Broderick)

	----------NDF as % of dry matter----------			Std.
	36	32	28	error
Dry matter intake, lb. per day	47.7	48.8	48.4	0.3
Bodyweight gain, lb. per day	0.9[b]	1.0[b]	1.6[a]	0.08
Milk, lb. per day	68.6[c]	74.6[b]	79.6[a]	0.6
3.5% FCM, lb. per day	72.3[b]	76.3[a]	75.5[a]	0.6
Milk fat, %	3.86[a]	3.7[b]	3.22[c]	0.07
Milk protein, %	2.95[c]	3.01[b]	3.08[a]	0.03
Efficiency				
FCM per dry matter intake	1.52[c]	1.56[b]	1.57[a]	0.02
Milk nitrogen per nitrogen intake	0.249[c]	0.269[b]	0.295[a]	0.004
Milk urea nitrogen, mg/dl	13.3[a]	12.7[b]	11.5[c]	0.2

4. Examples of high, medium and low nutritional value corn silages

	NDF, %	NFC, %	NDF dig., %	Dry matter dig. (48 hours), %
High	40.1	43.0	60.2	84.0
Medium	46.0	37.0	54.0	76.6
Low	53.0	30.7	55.5	70.0
BMR	39.0	37.0	64.0	86.0

5. Effect of maturity at harvest and harvest interval (Marble, 1974)

Maturity at harvest	Interval, days	Yield, tons/acre	TDN, %	ADF, %	CP, %	Stand	Price, $/ton	Value, $/acre
Pre-bud	21	7.5	56.3	26.3	29.1	29	191.50	1,436
Mid-bud	25	8.8	54.2	29.5	25.2	38	177.72	1,563
10% bloom	29	9.9	52.4	32.2	21.3	45	166.43	1,647
50% bloom	33	11.4	52.0	32.7	18.0	56	148.44	1,687

6. Effect of harvest interval on yield and quality at Rosemount, Minn., average of two 3-year experiments (Sheaffer, 1990)

Cuts per year	Season avg., tons/acre	Range avg., tons/acre	Avg. dry matter digestibility, %	Avg. CP, %
3	4.9	3.9-6.2	59	18
3	4.7	3.5-5.7	57	18
3	4.8	3.5-5.8	54	17
4	4.1	2.9-5.4	65	21
4	4.4	2.9-5.9	64	20
4	4.5	3.2-5.3	60	19

References

Broderick, G.A. 2003. Effects of varying dietary protein and energy levels on the production of lactating dairy cows. J. Dairy Sci. 86:1370.

Marble, V.L., 1974. Proceedings, Fourth California Alfalfa Symposium, University of California Cooperative Extension, referenced by S. Orloff and D. Putnam. 2007. Balancing yield, quality and persistence. Proceedings, National Alfalfa Symposium, December 2004 (alfalfa.ucdavis.edu).

Sheaffer, C.C., and G.C. Marten. 1990. Alfalfa cutting frequency and date of fall cutting. J. Production Agric. 3:486.

Undersander, D., and J.E. Moore. 2007. Relative forage quality (RFQ) – indexing legumes and grasses for forage quality. In: Proceedings, National Alfalfa Symposium. December 2004 (alfalfa.ucdavis.edu).