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Feeding Quality Forages to Improve Profits With Dairy Cattle

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Importance

The importance of quality forages in dairy rations cannot be over-emphasized. The key ingredient in forages is fiber, which dictates how much forage a cow can eat. Fiber in the forage also affects cud chewing, rumination and rumen health. Protein content in forage is important but does not affect intake. Usually protein affects the ration less than fiber because protein content can be increased with protein supplements.

All commercial feeds express the fiber component as crude fiber on the feed tag. In forages, fiber is most often expressed as acid detergent fiber (ADF) or relatively indigestible fiber and neutral detergent fiber (NDF). NDF most correlates with dry matter intake as it indicates total fiber. Forages should be harvested in the vegetative stage of growth because fiber content increases and forage intake decreases as forage matures.

Fiber content in forage affects income over feed costs (IOF) because additional concentrate, which is low in fiber and costs more per pound of nutrients, is required to balance the ration. In general, quality of forages is greater when ADF and NDF contents are lower.

Forage Quality

The quality of legumes and grasses is generally measured by the type and quantity of fibrous material in the plant. Neutral detergent fiber is the cell wall material of the plant. It is comprised of hemicellulose, cellulose and lignin and is relatively indigestible. Acid detergent fiber is comprised of cellulose and lignin and is more closely associated with digestibility than NDF. An increase in the indigestible lignin complex in the ADF fraction reduces digestibility of the plant. Therefore, ADF as well as NDF and digestibility are negatively correlated. Quality of legumes and grasses is best estimated by their potential dry matter intake and dry matter digestibility which are determined by the NDF and ADF content of the forage.

Grazing Management to Provide Nutrition to Dairy Cows

The key to maximizing use of forages and especially pastures with dairy cattle is to provide adequate quantities of high-quality forage. This plan of sound grazing management is built around four factors: (1) balancing the ration to meet the nutrient needs of the dairy cattle; (2) optimizing forage yield, quality and persistence; (3) protecting and enhancing the environment; and (4) integrating appropriate technology to develop a practical and economically viable management system to harvest the forage, such as grazing or baling and wrapping. All of these factors are closely interrelated and should be considered from a combined approach with your land, financial and cow needs.

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This integrated approach has to include a plan to match the forage needs of the dairy cattle to the purchase of feeds or growth of forages. In most cases of utilizing the forage as pasture, excessive quantities of forage must be planted so that yields are still adequate if there is a drought or other weather problems that affect yield and/or harvest. Excess forage can be harvested as hay. If acreage is not available to allow for extra forage, then an alternative source of forage is needed. Even with surplus forages, harvest should be at a stage of maturity to ensure a high-quality feedstuff.

The forage quality for grazing dairy cattle must be maintained just as with purchased or harvested forages. Producers should consider using intensive grazing systems such as strip grazing, time-limit grazing or leader-follower (high-producing cows graze first, followed by heifers or dry cows) to increase forage quality as compared to continuous grazing systems. Forage quality is the most limiting factor in milk production on many Arkansas dairy farms. It has a large influence on net returns from milk. (See income over feed costs of rations in Tables 2 and 3.) Although dairy cattle are fed high levels of concentrates, forages still play an important role in supplying energy, protein and other nutrients to the cow. Most significantly, nutrient cost per unit is less with forages than with concentrates. Thus, the backbone of the dairy feeding program is supplying a high-quality forage to the dairy cow so the forage does not limit milk production.

Because energy requirements of high-producing dairy cows are great and there is a limited physical capacity for the consumption of feed, providing high-quality forages to the milking dairy herd is critical. If poor-quality forages are fed, either milk production is reduced or additional concentrate must be fed to maintain milk production. Even then, high-fiber forages may restrict milk production as indicated in Tables 2 and 3. Maximum average milk production with the typical grass hay used in Tables 2 and 3 as the only forage source is 55 pounds per day. **Forages that are high in ADF and NDF are digested poorly and may restrict intake so that milk production is limited.**

Forages are essential to maintain a metabolic balance in the rumen. High-quality forages are generally digested more quickly than low-quality forages. This increased feed turnover allows the cow to consume greater quantities of other feeds as indicated by comparing rations in Tables 2 and 3. Also, high-quality forages provide greater amounts of nutrients to the cow than low-quality forages.

When feeding forages of different qualities, the amount of forage in the diet must be adjusted to obtain optimal amounts of fiber to ensure proper rumination and efficient milk production. If very high-quality forages, such as alfalfa with a relative feed value of greater than 200, are the only forage and fiber source, bloat and related problems may occur. A minimum amount of fiber is required in the ration. A similar problem may occur with only wheat for forage plus concentrate mix in the parlor. In such cases, long-stem hay of average quality should be available to the cows; cows usually consume 4-6 pounds of the hay each day, depending on the quality of the hay, to ensure that fiber is adequate.

If very low-quality forages are fed to high-producing cows, the concentrate levels required to meet their energy needs may cause them to experience digestive problems such as acidosis, displaced abomasum, founder and other problems related to low total fiber intake in the diet. The intake of low fiber is a common problem in low-producing dairy herds which feed more than 0.6 pound of concentrate for each pound of milk. In such cases, the feed is not used efficiently by the cows.

Rations

The composition of feeds used in ration formulations is shown in Table 1. The grass hay could be either fescue or bermuda or another grass harvested at a similar stage of maturity. For pasture, alfalfa is used as an example of a legume, and sudangrass is used to illustrate an annual grass pasture. Wheat, rye, ryegrass, fast-growing fescue or other grasses harvested in the vegetative stage of development should yield similar results.

Table 1. Feed Composition and Prices

Feed Name	Price Per Ton	Feed Limits		D.M.	Protein			TDN	ADF Fib	NDF Fib	NF Carb	Fat	Ca %	P %
		Min	Max		Crude	%UIP	%SoI							
18% dairy feed	$165	0.0	0.0	89.0	20.0	45	25	80	8.8	15.0	56.9	3.0	1.30	0.75
16% dairy feed	$155	0.0	0.0	89.0	18.0	45	25	76	13.0	22.0	52.3	3.0	1.24	0.75
Mostly grass hay	$60	0.0	0.0	88.5	9.0	35	20	52	39.5	60.0	24.4	2.5	0.50	0.25
Alfalfa pasture	$22	0.0	70.0	27.0	19.0	25	55	61	35.0	43.0	30.2	3.0	1.30	0.22
Sudangrass pasture	$17	0.0	70.0	22.7	8.7	25	50	63	40.0	68.0	17.8	1.8	0.43	0.41
Corn silage	$36	0.0	0.0	35.0	7.6	25	50	68	28.8	48.0	39.7	2.9	0.20	0.18

Table 2. Example Rations – 50 pounds milk @ 3.5% fat, $12/cwt.

Feed	Rations[1]							
	1	2	3	4	5	6	7	8
	- Lbs of Each -							
18% dairy feed	18.5	---	25.0	17.8	19.2	12.3	18.3	20.3
16% dairy feed	---	22.6	---	---	---	---	---	---
Mostly grass hay[1]	31.9	27.8	21.1	32.6[2]	24.0	14.9	14.1	10.3
Alfalfa pasture	---	---	---	---	---	70.0	---	---
Sudangrass pasture[3]	---	---	---	---	21.4	---	70.0	---
Corn silage	---	---	---	---	---	---	---	50.0
Income over feed costs	$3.52	$3.42	$3.30	$3.56	$3.48	$3.76	$3.47	$3.12
Total feed costs	$2.48	$2.58	$2.70	$2.44	$2.52	$2.24	$2.53	$2.88
Dairy concentrate costs	$1.53	$1.75	$2.06	$1.47	$1.58	$1.01	$1.51	$1.67

[1]Fescue or bermuda hay gives similar results.
[2]TDN = 60%, not 52%.
[3]Wheat, rye, immature fescue may give similar results.

Note: Income over feed cost is greater with higher TDN or lower fiber forages.

Table 3. Example Rations – 65 pounds milk @ 3.5% fat, $12/cwt.

Feed	Rations[1]							
	1[2]	2	3	4	5	6	7	8
	- Lbs of Each -							
18% dairy feed	26.8	26.9	27.8	30.0	31.7	19.2	29.3	30.2
16% dairy feed	---	---	---	---	---	---	---	---
Mostly grass hay	29.5[2]	23.7	10.0	5.0	10.0	10.0	7.2	20.0
Alfalfa pasture	---	---	---	---	70.0	40.0	---	---
Sudangrass pasture[3]	---	22.1	70.0	70.0	---	---	---	---
Corn silage	---	---	---	---	---	32.3	50.0	66.0
Income over feed costs	$4.70	$4.68	$4.62	$4.58	$4.42	$4.80	$4.27	$4.13
Total feed costs	$3.10	$3.12	$3.18	$3.22	$3.38	$2.90	$3.53	$3.67
Dairy concentrate costs	$2.21	$2.22	$2.29	$2.48	$2.62	$1.58	$2.42	$2.49

[1]Fescue or bermuda hay gives similar results.
[2]Maximum milk with "this" fescue or bermuda hay (52% TDN) is 55 pounds with $3.71 income over feed costs; ration 18.3 pounds hay + 33.6 pounds 16% feed; hay for ration 1 is 60% TDN.
[3]Wheat, rye, immature fescue may give similar results.

Information in Tables 2 and 3 shows that feeding primarily average grass hay or pasture as a forage usually causes milk production to be less than 55 pounds per day. If average grass hay is increased in energy from 52 percent to 60 percent TDN (as in Table 2 – ration 4 and Table 3 – ration 1), less additional feeds such as concentrate mixes are needed to balance the ration. If this grass can be harvested to produce a forage that is immature and contains 60 percent TDN, less concentrate mix will be needed to obtain 50 pounds of milk per day. The difference in concentrate costs in Table 2 for rations 3 and 4 is $0.59/cow/day. For 100 cows/year, the difference is $21,535.

Table 3 illustrates that the most significant benefit of improving forage quality is that the cow can eat more, which provides greater nutrients to the cow; then milk production increases and IOF (milk income minus feed cost) increases. **This increase in**

milk production results in an IOF of around $1/cow/day greater for rations 2-8 in Table 3 compared to rations in Table 2. Although many factors affect profitability on the dairy farm and some costs will increase with the higher-producing cows, there is more money leftover to pay additional expenses with the higher-producing cows. If this additional profit is $0.70/cow/day, the additional net return to the dairy herd is $25,500/year for 100 milking cows. The effect of forage maturity and quality on milk production increases as the level of milk production increases. Maturity of the forage has less effect on cows producing 50 lbs/day of milk compared to cows producing 65 lbs/day of milk.

Up to an average of about 70-80 pounds of milk per cow per day, pasture will usually maximize income over feed costs because of less feed costs (primarily because of less harvesting and storage costs); however, above 70 pounds of milk, pasture intake may decrease due to the high water content of the forage. The primary problem in Arkansas is maintaining high-quality pastures throughout the year. Seasonal growth patterns and weather conditions cause pasture quality and quantity to decline and milk production to decline.

Feeding extra high-quality forage in the summer can be an excellent investment when pasture is limited. If you feed 5 pounds of alfalfa hay and get an additional 5 pounds of milk production during the summer, you will invest 30 cents per day if alfalfa is $120/ton to obtain a 50-60 cent return per cow. It is critical to ensure that milk production is increased. Moreover, the price of alfalfa hay often exceeds $160/ton which may result in greater profit by feeding a high-quality grass hay at less total cost. Balance the ration with other feed components that are available plus alfalfa to verify that this increase in production is likely to occur. For assistance, see your county Extension agent or local feed dealer. Ration balances do not ensure that the desired level of production will be obtained. Other factors may limit production.

Many options are available for planning for adequate feed throughout the year by using combinations of the following: (1) permanent pasture, (2) temporary annual pasture and (3) stored feed. Forage fact sheets are available at your local county Extension office. The topics include cool-season forages such as wheat, ryegrass, rye and fescue; as well as warm-season forages such as sorghum crosses, bermuda, alfalfa, clovers, fescue, etc.

Summary

1. Forages are a major economic source of nutrients in the ration of lactating dairy cows.

2. The importance of the fiber content of forage increases as the level of milk production increases. Fiber content can limit total dry matter intake. High-producing cows must eat more than lower-producing cows.

3. An adequate amount of fiber is required in the diet to maintain normal animal health and rumen function. High-quality annual forages such as wheat may be best supplemented with a few pounds of average grass hay plus concentrate mix to balance the ration.

4. Feeding average- or poor-quality forages may limit milk production per cow and income-over-feed costs. Higher-producing cows usually have greater income-over feed costs than lower-producing cows.

5. A combination of forage species and physical forms (such as pasture, hay or silage) may be used to provide nutrients in the ration of high-producing cows. Calculate rations to determine greatest income-over-feed costs and then monitor the levels of milk production and dry matter intake of the ration to ensure economical milk production.

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