



Limit-feeding Strategies for Beef Cows

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Typical beef cow management strategies call for maximizing forage use, and supplementation strategies are often designed to optimize forage intake and digestibility.

One of the most cost effective methods of producing beef is by using feedstuffs that other livestock species cannot use. However, environmental and/or financial conditions sometimes cause producers to consider alternative feeding systems. When costs of forages are relatively high, such as those resulting from drought, cows can be drylotted on other feed resources. Limit-feeding rations containing either grains or hay that may lower cost per day can be designed to meet the cow's nutrient requirements.

Limit-fed grain or byproduct-based diets

Limit-feeding of grain or byproduct-based diets has been used effectively to provide nutrition to wintering beef cows. In certain circumstances, a limit-fed grain-based diet for gestating cows may be more economical than forage-based diets, especially if there are significant transportation expenses associated with buying hay. Alternatively, a limit-feeding strategy in a drylot may help producers avoid selling productive cows in a depressed market. In these situations, a minimum amount of roughage is provided to maintain rumen health and to minimize digestive upsets, and then limited amounts of energy dense feeds that have a lower cost per unit of dietary energy are used to provide the balance of the required nutrients.

Research conducted during the winter feeding period at The Ohio State University (OSU) has shown that pregnant cows can be fed

diets with as little as 3 lb. of hay plus corn and supplements to meet requirements. The cows received 2 lb. of supplement (protein, vitamins and minerals plus an ionophore) and 12 to 14 lb. of whole shelled corn per day. Performance was similar between cows on the limited-hay diet compared to cows given free-choice first-cutting orchard grass hay. This result would be expected since the cows' nutrient requirements were being met by both diets. However, the cows on the limited forage diets did appear to be hungry.

Research conducted at Purdue University (Purdue) showed that hay intake (DM basis) could be limited to 0.5% of a cow's body weight (BW). Researchers compared performance during the last trimester of gestation of cows fed at 0.5, 1 and 2% of BW of hay DM per day. Nutrient requirements were met by balancing the rations with whole shelled corn, protein supplement, minerals and vitamins. Cows fed any of the three levels of hay had similar performance when fed orchard grass hay (12.2% CP) in year 1 (Table 1). When lower quality hay (7.8% CP) was used in year 2, there were differences in weight gain over the 105-day feeding period. Cows on the 0.5 and 1% hay treatments gained more weight than those on the 2% treatment.

Other grain sources can be used successfully to limit-feed cows. In a trial at the SDSU Cottonwood Research Station, researchers compared the performance of wintering cows in late gestation fed limited amounts of alfalfa hay (1.6% of BW) to that of cows fed diets where rolled barley replaced alfalfa hay at either 29 or 67% of the diet dry matter. Cows fed the barley-based diets gained more weight and body condition than did cows fed alfalfa hay. The choice of grain would ultimately depend upon costs and availability.

Byproducts of grain processing can also be utilized as substitutes for hay. These feeds can be especially useful in beef cow diets because of higher levels of digestible fiber and reduced starch content compared to grains. Using highly digestible fiber sources such as soybean hulls, wheat middlings, or distiller's grains can help avoid potential digestive problems associated with feeding grain-based (starch) diets while maintaining energy intake.

In a study conducted at OSU, gestating beef cows were fed diets based on hay or limited amounts of shelled corn or dried distiller's grains (DDGS) such that all diets met or exceeded NRC (National Research Council) cow requirements. Cows fed DDGS gained more weight during gestation, but there were no differences in subsequent reproductive performance. Cows that were limit-fed either corn or DDGS did have calves with increased birth weights, but there were no differences in the incidence of calving difficulty.

When utilizing byproduct feeds, particularly ethanol byproducts, it is important to make sure that nutrients, such as sulfur and fat, do not exceed maximum recommended levels. Dietary sulfur should not exceed 0.3% for cattle consuming diets containing 85% or more concentrate and 0.5% for cattle consuming at least 40% forage (all on a DM basis), and fat content should not be over 5 to 6% of the diet on a dry basis. These restrictions limit the amount of certain byproducts that can be fed to cattle, especially distiller's grains. Nutrient composition of distiller's grains varies, depending upon the procedures at a particular ethanol plant, so it is important to utilize recent feed analyses when determining how much distiller's can be included in a ration. It's also important to consider the sulfate content of the water source when you are determining the amount of byproduct feeds that can safely be fed.

The variability of some byproduct feeds can cause unacceptable performance if that variability is not managed and the cattle's performance is not monitored. Researchers at the Carrington Research Extension Center (North Dakota) noted that cows fed sunflower screenings lost a significant amount of weight and body condition, resulting in a decreased conception rate. This was attributed to changing nutrient composition of the screenings over time, an issue that can make balancing a diet difficult.

Changing from a forage-based diet to one containing a greater proportion of grains or byproduct feeds also may change mineral supplementation needs. Many of these feeds contain relatively high levels of phosphorus and lower levels of calcium compared to typical forages. Because of those differences, supplemental phosphorus needs can be reduced or even eliminated; however, supplemental calcium may need to be added. As long as dietary requirements have been met, the calcium:phosphorus ratio can range from 1.5:1 to 7:1 without causing metabolic disorders.

Limiting access to hay

Limiting the amount of time cows have access to hay is another method of reducing forage usage. Ron Lemenager at Purdue conducted experiments over a three-year period to study how much hay was consumed when cows were given only a limited amount of time to eat. Forage intake was reduced by as much as 75%, 60%, and 33%, respectively, when cattle were restricted to one, two or three hours access to hay compared to cows having free access to hay. Soybean hull pellets were used to meet the balance of the cows' nutrient requirements.

In order to successfully implement this strategy, the amount of forage consumed must be accurately estimated so that the diet can be supplemented correctly to maintain acceptable cow performance. To determine the relationship between hay quality and hay intake under free-choice and restricted conditions, researchers at Purdue compared the amount of hay consumed when cows were allowed one, two, four or 24 hours per day access to low, medium or high quality grass hay during late gestation.

As shown in Table 2, forage intake increased as hay quality improved regardless of the access time allowed. Restricting access decreased the amount of hay consumed. The reductions in hay intake due to access restrictions were similar for the low, medium, and high quality roughages.

Using these results, the researchers at Purdue developed the following equations to estimate ad lib and time restricted hay intake. Ad lib dry matter intake of forage per head per day for cattle can be estimated from the calculation:

- $120 \text{ divided by NDF \% (neutral detergent fiber; DM basis) = hay dry matter intake (expressed as \% cow body weight)}$.

The following equation estimates forage intake based on NDF content and length of hay access time.

- $0.3 \times \text{hours of access/day} - (0.02 \times (\text{hay DM NDF \%} \times 100)) + 1.34 = \text{hay dry matter intake (expressed as \% cow body weight)}$ where the NDF % is expressed as a decimal.

Example: 4 hours of hay access, 53% NDF on DM basis, 1,300 lb. cow

- $0.3 \times 4 \text{ hours} - [0.02 \times (0.53 \times 100)] + 1.34 = \text{DM intake of hay (\% of bodyweight)}$
- $1.2 - (0.02 \times 53) + 1.34 = 1.2 - 1.06 + 1.34 = 1.48\%$ of body weight as dry matter hay intake when limited to 4 hours
- Estimated ad lib intake of this hay: $120 \div (0.53 \times 100) = 2.26\%$ of bodyweight
- $1,300 \text{ lbs. cow} \times 1.48\% = 19.2 \text{ lbs. of DM hay per day when limited to 4 hours}$
- $1,300 \text{ lbs. cow} \times 2.26\% = 29.4 \text{ lbs. of DM hay per day ad lib intake}$

In this example, the amount of hay consumed per day would be reduced by 10.2 lb. per day on a dry basis (34% reduction). Assuming that the feeding period was 120 days long and that the hay was 88% dry matter, this system would result in a feed savings of 1,390 lb. per cow.

The amount of space provided and the design of the hay feeders also may play a role in the amount of hay that is wasted and, therefore, the amount of hay that must be provided each day. Research at Michigan State observed that cows fed with cone-type hay feeders wasted the least amount of hay (3.5%) compared to 6.1, 11.4 and 14.6% for ring, trailer and cradle feeders, respectively. Regardless of feeder design, there should be enough room available so that all cows can access the hay at the same time.

Management factors

Limit-feeding cows does represent a significant departure from more conventional management practices. There are some management factors that should be considered to successfully implement these strategies. These include:

- 1) All feedstuffs should be tested for nutrient composition and nitrate levels, if appropriate. That information can then be used to formulate diets that meet the animals' requirements at the best cost.
- 2) Gradually step up the animals onto the energy dense feeds. One approach is to start cattle at 4 lb. per head per day and then add 1 lb. every other day until the desired amount of energy dense feed is reached. As the amount of energy dense feed increases, the forage portion of the diet should be gradually reduced.
- 3) When diets containing a higher proportion of grain are fed to cows, proper bunk management to avoid digestive upsets is extremely important, especially when high-starch feedstuffs like grains are fed. Minimizing the day-to-day variation in grain intake will help reduce the incidence of acidosis and bloat. Monensin is labeled for use in mature beef cows and has been shown to help reduce the incidence of bloat and acidosis along with increasing feed efficiency.
- 4) Implementing a limit-feeding strategy will be easier if a mixer wagon and a scale are available. It's important to allow for sufficient mixing time so that all ingredients are distributed evenly throughout the load. If mixing equipment is not available, offering a fixed amount of a supplement combined with limiting the amount of time cows have access to hay can be effective.
- 5) Mineral and vitamin mixes may be over consumed if offered free-choice when animals are limit-fed. These could be included in the mixed ration, or consumption could be controlled using white salt.
- 6) Adequate bunk space (30 inches per head) should be provided to allow all cattle an equal opportunity to consume the ration.
- 7) Pens should provide at least 500 square feet per head. It may be worth considering sacrificial pasture areas as a way to provide additional room and to mitigate the effects of muddy conditions during wet and inclement weather.
- 8) While the nutrient requirements of the cattle can be met using limit-feeding strategies, their appetites will not be satisfied. Fences will need to be strong enough to withstand mature cows pushing against and reaching through in an attempt to graze plant material that may be within their reach.
- 9) As with any feeding system, monitor body condition to determine if nutritional demands are being met. Adjust diets if needed to avoid under- or over-conditioning.

Limiting forage intake can be a successful strategy to reduce feed expenses under certain conditions, or as a strategy to avoid herd liquidation. The success or failure of a limit-feeding system will depend on the resources available and their cost and the ability to provide the level of management required to implement this strategy. **HW**

Item	Treatments		
	2% Hay	1% Hay	0.5% Hay
Year 1			
Initial wt., lb.	1,279	1,274	1,260
Initial BCS	5.2	5.1	4.9
Wt. change, lb.	96	110	83
BCS change	-13	-14	-06
Year 2			
Initial wt., lb.	1,281	1,271	1,279
Initial BCS	4.7	4.7	4.7
Wt. change, lb.	56	102	111
BCS change	-14	0	-20

BCS = body condition score (9 point scale, 1 = emaciated to 9 = obese) (Walker et al., 1990)

	Access time (hours/day)			
	2	4	8	24
Low quality grass hay diet – late gestation				
Hay consumption as-fed, lb.	8.2	14.5	23.8	29.0
Soybean hulls, lb.	13.2	10.5	6.7	4.6
Mixed hay diet – late gestation				
Hay consumption as-fed, lb.	9.8	16.8	25.0	32.0
Soybean hulls, lb.	11.3	7.5	3.1	0.0
High quality grass hay diet – late gestation				
Hay consumption as-fed, lb.	10.4	17.1	27.5	35.0
Soybean hulls, lb.	10.7	6.9	1.0	0.0

Animals were 1,250 lb. cows, gaining .25 lb./d in late gestation (8 months pregnant)

Low quality hay = 47.3% TDN, 8.1% CP

Mixed hay = 54.0% TDN, 12.5% CP

High quality hay = 56.7% TDN, 17.1% CP soyhulls = 80% TDN, 12.2% CP (NRC 1996) (R. Lemenager, personal correspondence)