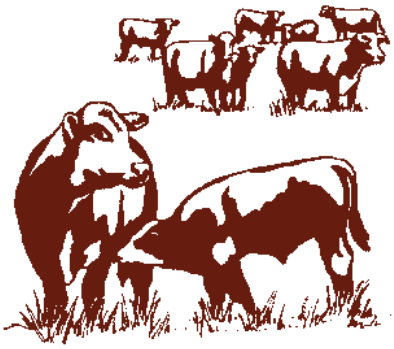
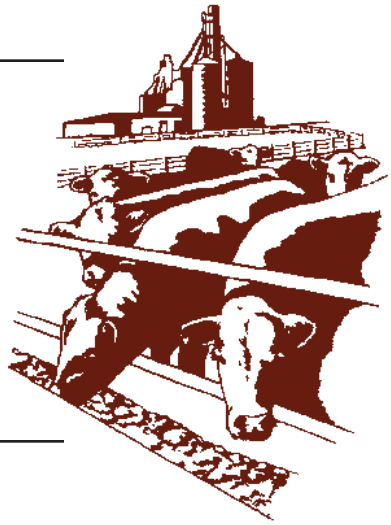


Beef Cattle Handbook



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Limit Feeding Beef Cattle

Dan B. Faulkner, University of Illinois, Urbana
Larry L. Berger, University of Illinois, Urbana

Cattle are normally fed under ad libitum condi tions (allowed to eat according to appetite). Generally, this allows for maximum performance because energy consumed above the maintenance requirement is available for gain. However, recent work suggests that limit-fed animals may have better feed efficiency. This has economic importance in that changes in feed efficiency have three times the impact on cost of gain as an equal change in rate of gain. Limit feeding also allows a producer to target weights for breeding cattle, grass cattle or marketing of cattle. It also reduces the amount of manure produced which must be utilized.

Animals fed under ad libitum conditions will have fluctuations in feed intake. These fluctuations may result in decreased feed utilization due to digestive disturbances. It is also important to realize that as intake increases, rate of passage increases and digestibility decreases. As feed moves through the gastrointestinal tract faster, digestibility is reduced because the feed is exposed to digestive processes for a shorter time. It is possible that a reduction in feed intake will improve digestibility. The improvement in digestibility with limit feeding has been observed in several experiments and has resulted in better than predicted animal performance.

There is also interest in limit-feeding high energy diets to beef cattle because corn and some co-products can be cheaper sources of energy than hay or other roughage. Table 1 illustrates the relative energy costs of corn and hay.

Facilities

It is important that fences be well maintained because limit-fed cattle will challenge them early in the feeding program. Other facility needs are similar for ad libitum and limit-fed cattle except for bunk space. Portable bunks can be used if permanent feed bunks are not available, but adequate bunk space is critical.

Table 1. Relative Energy Cost of Hay and Corn

Energy Cost $/lb. DM	Hay[a] Cost $/ton	Corn[b] Cost $/bu
.046	44.57	2.00
.058	55.88	2.50
.069	67.06	3.00
.081	78.49	3.50
.092	89.41	4.00

[a] *Mid Bloom Alfalfa - Orchardgrass, 57% TDN. 15% Moisture*
[b] *Corn, 91% TDN, 15% Moisture*

The amount of bunk space needed for limit-fed cattle has not been well established. It has been assumed that six inches per animal is adequate for ad libitum fed cattle on high energy diets. When cattle are restricted or fed high roughage diets the recommendations have been increased to 1.5-2 feet per animal. This allows the feed to be distributed so that all cattle can eat at one time. Zinn (1987) conducted a study to evaluate the effect of bunk space on animal performance. Sixty-four steers were sorted by weight into light and heavy groups and randomly assigned to 16 pens and four

manger space allotments (6, 12, 18 and 24 in.). The weight gain was very close to that targeted (1.32 kg). Manger space did not influence the variability of within-pen weight gain as indicated by the coefficients of variation (CV). However, there was a significant interaction between sort group and manger space allotment on animal performance ($P < 0.05$, Table 1). Weight gain and feed efficiency were improved linearly with increasing manger space in steers of the light sort, while the opposite effect was observed in the heavy sort. This emphasizes the importance of sorting cattle which are to be limit-fed.

Cattle Management

For successful limit feeding, cattle need to be sorted into uniform groups by size, age and/or condition. It is also important that the cattle be healthy and adapted to the facilities prior to starting a limit feeding program. Cattle should be adapted to a high energy limit-fed diet gradually to reduce the possibility of digestive upset. Cattle should also be observed to ensure that all cattle are consuming the diet, and that aggressive animals are not over consuming feed. Generally, there is less within-pen variation in gain with limit feeding, which indicates that variable intake is not a major problem.

Feed Management

Limit feeding minimizes day to day variation in feed intake and might improve digestibility as discussed earlier. It also improves feed bunk management because it reduces or eliminates the need for bunk cleaning. Because of the reduced intake and improved digestibility, less manure is produced, which reduces handling costs for feed and manure. The lower feed intake will reduce heat production, which could result in less heat stress in the summer. In extremely cold weather cattle may need more feed for heat production. A ten percent increase in feed intake in cold weather can be made with little concern. Further increases should be introduced gradually to minimize digestive upsets. If the schedule is broken it may be necessary to feed poor quality roughage to fill the cattle before resuming the limit feeding program.

Roughage availability is seasonal, which results in money being tied up in roughage inventory to ensure adequate supplies for the entire year. Limit feeding reduces the amount of roughage to be purchased. Grain purchases could be increased, but there is good year around availability of grains. These two factors result in easier control of feed inventory with limit feeding. One potential disadvantage of limit feeding is that it reduces the amount of feed sold for custom feeders.

Corn or other concentrates are often the least expensive source of nutrients, but co-products can often be an excellent high energy feedstuff. Wet corn gluten feed is one co-product that has been used successfully in limit-fed diets (Berger and Willms, 1991-92). The need for corn or other grains to be processed in a limit feeding situation, is often questioned. Some data (Faulkner et al., 1994) suggests that corn does not need to be processed when utilized in a limit feeding situation for lactating cows fed hay at one percent of body weight.

Diet Formulation and Feed Intake

Zinn (1987) used the following equation to estimate the required intake to achieve a desired rate of gain.

$$F = ((((0.05272 * G) + (0.00684 * (G^2))) * (W^{.75}))/NG) + ((0.077 * (W^{.75}))/NM)$$

In this equation F is daily feed intake in pounds, G is daily weight gain in pounds, W is body weight in pounds, and NM and NG are net energy content of the diet per pound for maintenance and gain, respectively. This equation was derived from Lofgreen and Garrett (1968). Intake must be adjusted as the cattle get heavier or change stage of production. For calculators that do not have the ability to calculate $W^{.75}$, take the weight times itself three times and the square root of the answer twice. For a 500 lb. calf, the calculation would be 500 x 500 x 500 = 125000000, take the square root = 11180.34, take the square root again = 105.7 which is $W^{.75}$ for a 500 lb. calf.

Estimates of NM and NG can be obtained for diet formulation using tabular values for individual feed ingredients (i.e., NRC, 1984). These values can be adjusted by comparing tabular estimates of the net energy value of the diet, with estimates of the net energy value of the diets from prior closeouts for feed intake and weight gain.

Limit Feeding Cows

In cow diets the benefit of limit feeding will be related to the relative costs of roughage, concentrates and protein supplements. Grains can be a less expensive source of energy than roughage so we may wish to limit feed diets high in grain. Generally a diet for cows should contain about 40 percent roughage to maintain rumen function. Diets lower in roughage may permanently impair digestive function. Corn silage is an example of a feed that is near this level in roughage value that needs only protein and mineral supplementation for a complete diet. Wet corn gluten feed also contains high levels of fiber and may need only mineral supplementation to be limit-fed. Limit feeding cows might reduce subsequent forage intake. This could be a limitation for cattle returning to pasture.

Limit Feeding Growing Cattle

Growing cattle benefit from limit feeding for the same reasons as cows. The roughage level can be somewhat lower with the acceptance of increased risk of digestive disorders. Because most growing cattle are destined for slaughter fairly soon, this risk is not as substantial as that for cows. The exact level of roughage needed is determined by the level of management and the risk that is acceptable to a producer. There is probably no need for this type of program for large framed exotic calves. It is probably better suited for smaller framed calves that need to be grown prior to finishing.

Growing cattle adapt to finishing diets with less dif-

ficulty if they have been limit-fed. Often the grain portion of the diet can be gradually increased until the cattle are on the finishing diet. Limit-fed cattle have had lower intakes and improved efficiencies in the finishing period compared to cattle fed high roughage diets ad libitum (Merchen et al., 1987). Limited data suggest that cattle fed high energy diets at restricted intake during the growing phase may have lower maintenance requirements in the finishing phase, compared to cattle fed ad libitum high roughage diets during the growing phase (Hicks et al., 1990; de la Torre et al., 1994).

Limit Feeding Feedlot Cattle

Feedlot cattle are normally fed under ad libitum conditions (allowed to eat according to appetite). Feedlot managers have felt that this allows maximum weight gain because any energy above that for maintenance goes for gain. However, recent feedlot work suggests that small limitations in feed intake may improve feed efficiency.

In several studies (N = 15) where feed intake was restricted from 5-20 percent (mean 11.4 percent), the gain response was 5.5 percent lower than ad libitum fed cattle and quite variable from -20-7 percent (Murphy and Loerch, 1993; Hicks et al., 1990; Plegge, 1987). Feed efficiency was improved (mean 3.5 percent, range -1-9 percent) in all the studies but one. The greatest improvement in performance from limit feeding appears to be when feed restriction was 4- 8 percent of ad libitum. These results indicate that slight restrictions in intake in finishing diets may be beneficial in improving efficiency, but when feed intake has been limited to less than 87 percent of ad libitum, cattle performance has been reduced.

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Authors:
Dan B. Faulkner, University of Illinois, Urbana
Larry L. Berger, University of Illinois, Urbana

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