# Can We Allow a Calf to Have a Bad Day?

**Dr. Matt Hersom**[1]

[1]Assistant Professor, UF/IFAS Department of Animal Sciences Gainesville, FL

## Introduction

Recently much discussion has been dedicated to the management of calves prior to entering feedlots and finishing programs. There is an increasing volume of dogma that says we should never let a calf have a "bad day". If a calf has a bad day anytime during the growing period the subsequent feedlot growth performance and carcass quality will be negatively affected. Specifically, if a calf is nutritionally restricted at some point prior to the finishing period, then the marbling deposition will be adversely affected compared to if the calf was not ever restricted. Unfortunately, much of the work that is used to support this supposition is incorrectly compared and confounding factors are ignored. Some of these confounding factors include limit feeding high energy diets, breeds types (specifically dairy), early weaning, and implant regimen (Oltjen, 2008). This discussion will offer an alternative to the pervasive dogma and show that calves can be limited in gain and/or nutritional status during a defined production period and still perform to producer and industry standards.

## What Constitutes a Bad Day

Some of the most cited data indicating that a calf should never have a bad day is the Texas A&M Ranch to Rail data. A summary of this data indicates that sick cattle have greater death loss, average daily gain (ADG) that was 14% less, greater percent Select and less percent Choice carcasses, and decreased net returns (McNeill, 2001). Likewise, Gardner et al. (1999) reported an association between lung lesions and decreased ADG and quality grades when cattle were harvested. These lung lesions likely developed prior to placement into the feedlot and had long-term implications on calf performance during finishing. Certainly, we never want to see cattle get sick prior to placement into the feedlot or during the finishing period because there are definitive negative outcomes associated with morbidity in the feedlot. The cascade of negative events that an illness initiates for a growing calf is one that must be avoided. Management practices including adequate cow nutrition, comprehensive cow-herd health programs, and calf-hood vaccination programs are positive steps to avoid the negative outcome associated with calf sickness. However, neither the Texas Ranch to Rail nor Gardner et al. (1999) indicate that prior nutrition (aside from poor overall cow herd nutrition as it relates to immunity and health) has negative effects on feedlot performance or carcass quality.

From a nutritional stand-point, a bad day could be construed as a limitation in dry matter intake (DMI), dietary crude protein (CP), or dietary energy intake. In many cases the limitation could be any combination or all of the previously mentioned for any amount of time. In many of our beef production systems cattle do go through some limitation associated with DMI, CP, energy, or a combination. Some of the common production systems that would fall in this category include: cornstalk grazing, winter grazing on native ranges, limited availability of winter annuals, or program feeding of mixed rations. All of these production systems have been and continue to be incorporated into current beef production systems successfully. Often the utilization of these nutritionally limiting systems is then followed by the expectation of compensatory growth in the subsequent feeding period, particularly feedlot finishing. However, compensatory growth is a finicky phenomenon that cannot always be counted on to occur. Generally, compensatory growth by cattle is defined as 1) increased rate of ADG; 2) more efficient rate of body weight (BW) gain (Fox et al., 1972; Ferrell et al., 1986; Sainz et al., 1995); and 3) reduced maintenance energy requirements (Fox et al., 1972) during the realimentation period (adequate nutrition period). The occurrence of compensatory growth and the overall response to restriction is highly variable (Coleman and Evans, 1986; Drouillard et al., 1991, NRC, 1996). The compensatory growth response of cattle consuming roughage-based diets appears to depend on the genetic gain potential of the cattle. The growth potential of a steer with adequate nutritional intake will cause the ADG to be such that final BW of normal and realimented steers will be similar given adequate opportunity for gain. In general, most studies report an increase in ADG, DMI, and ADG:DMI during the early compensatory period and a number of studies report increased ADG of compensating animals during the entire realimentation period. The most variable response was DMI, in that some studies did not report significant differences in DMI between normal and compensating animals. One general observation was that the degree of compensation during realimentation was inversely related to the severity of the previous nutrient restriction.

**End-Point Comparison**

The single largest misconception or fallacy in the discussion of allowing growing calves to have nutritionally poor days is the final end-point comparison. The largest issue is comparing cattle at different final end-points (Klopfenstein, 2000). Often the end-point comparison utilized to support the dogma that a lower plane of nutrition is detrimental is to compare cattle after a total number or common number of days on feed. The comparison comes about by handling one group of cattle in a "normal manner" that are moved through the growing-finishing program quickly; conversely the other group of cattle is managed in a more extensive, nutritionally challenging program until finishing. The extensive group of calves is then finished for the same number of days as the normal group. When compared, the extensive managed group always performs inadequately compared to the normal group. Well of course! If the extensive group is allowed less time on the high-energy diet (which drives adequate feedlot and carcass performance) those calves will not perform as well as the normal cattle. Upon critical consideration most people would say that we don't market cattle based solely on days on feed, but rather cattle in feedlots are usually fed to a predetermined estimated back fat. Feeding to a set final backfat is an attempt to provide the majority of the cattle the opportunity to reach the quality grade that is desired (Choice, High-Select, etc.) Therefore, to make valid comparisons between two different groups of cattle all cattle need to be taken to the same *physiological* end-point, not day of age or days on feed.

**Effect of Feed Restriction on Growth and Carcass Performance**

A period of grazing is often incorporated into production systems for beef cattle. However, the effects of season and weather have large effects on quantity and quality of available forage (Lawerence and Pearce, 1964). Restrictions include DMI, energy, and (or) CP intake, which will reduce animal performance. However, when previously restricted cattle are refed they exhibit compensatory growth (Fox et al., 1972; Ferrell et al., 1986; Sainz and Bentley, 1997). Seasonal patterns of forage growth result in variations in forage availability and forage nutritive value, and this greatly influences cattle performance.

Much has been made of the importance of getting cattle exposed to high-energy diets early in life to facilitate greater carcass quality through increased marbling. Several production methods are available to accomplish the exposure to high-energy diets or feedstuffs. The methods include creep-feeding, early weaning, or high-energy growing programs. Wertz et al. (2001) examined the opportunity of early weaning to affect performance and carcass characteristics. One experiment early weaned Angus x Simmental calves and placed them on endophyte-infected fescue pasture, a 90% concentrate diet, or a 25% concentrate diet during the growing period, then finished the calves to common final backfat endpoint. Early weaned calves placed on endophyte-infected fescue could be considered to be in a nutritionally challenged environment because of the detrimental effects of the endophyte on growing cattle performance. Table 1 provides the results of this experiment. Pastured calves were older and heavier entering and leaving the feedlot, and had greater ADG, DMI, but lower gain efficiency. Carcass weight, ribeye area, KPH, and yield grade were greater for pastured calves compared to calves that were started on concentrate diets.

Sainz et al. (1995) utilized a 75%- high-concentrate diet fed ad libitum or limit-fed and a 96% hay-roughage diet (restriction of energy intake) fed ad libitum to steers that created three treatments to examine compensatory growth (Table 2). During the growing phase, ADG was 4.32, 1.52 and 1.70 lb/d for concentrate-ad libitum, concentrate-limit fed and roughage-fed steers, respectively. During the subsequent finishing phase all steers were fed the same concentrate diet. Steers that were previously limit-fed had the greatest ADG followed by the roughage-fed steers and then ad libitum-fed steers (4.23 > 3.83 > 2.69 lb/d, respectively). Dry matter intake of both restricted treatments was greater than DMI intake by the ad libitum steers (25.02 vs. 19.91 lb/d). Gain efficiency of limit-fed steers was 23% greater and 9% greater in roughage fed steers compared with the ad libitum steers. Final BW were 66 lbs greater for intake-limited and roughage-fed steers compared with ad libitum-fed steers. Subsequent analysis determined that previously limit-fed steers had the lowest estimated maintenance energy requirements, whereas the roughage-fed steers had increased maintenance energy requirement compared with steers fed the concentrate diet ad libitum. At the final harvest, after ad libitum intake of the high-concentrate diet, all treatments had similar carcass qualities with the exception of forage fed steers having slightly smaller ribeye areas.

Work by Phillips et al. (1991) examined the effect of pre-weaning grazing pressure and stocker system on feedlot finishing and carcass characteristics of Brahman crossbred calves. Pre-weaning grazing pressure was described as Low (2,800 lb forage dry matter/ 100 lb calf BW), Moderate, Moderately High, and High (440 lb forage drymatter/ 100 lb calf BW) grazing pressure. Across three years, pre-weaning management did not affect subsequent performance during the receiving period, stocker phase, or feedlot phase. Likewise, stocker treatment of grazing wheat pasture grazing or tallgrass native range had no effect on carcass characteristics or DMI. Wheat-pasture calves started the finishing period 72 lb heavier coming off the high-quality forage, whereas native range calves were 10% more utilized high-concentrate diet, 50% concentrate diets fed to a defined BW, or grazed wheat pasture to a defined BW as growing system programs prior to finishing (Table 3). Despite differences in growing period ADG and differences in feedlot ADG as a result of the growing period, carcass characteristics were only slightly greater for steers fed the high-concentrate diet for dressing percent, KPH, and ribeye area. The close similarity of the carcass characteristic of the steers in these programs occurred because all steers were finished to a common backfat end point.

Hersom et al. (2004) best examined the effect of growing period BW gain on subsequent finishing performance and carcass characteristics. Three grazing regimes were implemented during the growing phase: grazing winter wheat pasture to achieve high (2.65 lb/d) or low (1.34 lb/d) rate if BW gain, or grazing dormant native range (0.33 lb/d). Steers grazed for 120 or 144 days in two years. Figure 1 demonstrates the pattern of BW gain during both the grazing and feedlot phase. Steers were finished to the same final backfat end point, but days on feed differed among the three treatments. The steers entered the feedlot at very different BW and body compositional points. However, feedlot performance and carcass characteristics did not differ among the three treatments (Table 4), because the steers were fed to the same compositional endpoint. However, the absence of difference in finishing performance was not entirely expected, current industry dogma would have predicted decreased performance for the fleshy high gain wheat steers and compensatory gain for the low gain wheat and native range steers. This data would indicate that price discounts for the heavier feeder cattle coming off wheat pasture would not have been justified in relation to their subsequent finishing performance, likewise price premiums for the lighter BW calves would have not likely have been warranted.

Table 1. Finishing performance of early-weaned heifers grazed on pasture and finished as yearlings or finished as calves after growing on 90 or 25% concentrate rations [1]

| | Growing Period Treatment | | |
|---|---|---|---|
| Item | Pasture | 90% Concentrate | 25% Concentrate |
| Feedlot entry age, d | 588[a] | 216[b] | 214[b] |
| Days on finishing diet | 218 | 258 | 258 |
| Initial BW, lb | 826[a] | 390[b] | 396[b] |
| ADG, lb/d | 3.26[a] | 3.02[b] | 2.86[b] |
| DMI, lb/d | 26.8[a] | 19.4[b] | 19.8[b] |
| Feed:gain | 8.26[a] | 6.41[b] | 6.90[b] |
| Hot carcass wt, lb | 958[a] | 725[b] | 691[b] |
| Ribeye area, $in^2$ | 14.2[a] | 12.4[b] | 12.6[b] |
| Back fat, in | 0.63[a] | 0.63[a] | 0.46[b] |
| KPH, % | 3.0[a] | 2.1[b] | 2.1[b] |
| Marbling score | Modest [12] | Modest [37] | Modest [99] |
| Quality grade | Avg Choice | Avg Choice | Avg Choice + |
| Yield grade | 3.8 | 3.3 | 2.6 |

[1] Adapted from Wertz et al. 2001.
[a,b] Means with different superscripts differ $P < 0.05$.

Table 2. Effect of diet type during growing period on finishing steer growth and carcass performance [1]

| | Growing Treatment | | |
|---|---|---|---|
| | Concentrate- Ad libitum | Concentrate Limited | Forage Ad libitum |
| BW after growing phase, lb | 775[a] | 683[b] | 700[c] |
| Final BW, lb | 1,033[a] | 1,095[b] | 1,106[b] |
| Hot carcass wt, lb | 678[a] | 667[a] | 652[b] |
| Backfat, in | 0.50[a] | 0.46[ab] | 0.39[b] |
| KPH, % | 1.6[a] | 1.9[ab] | 2.1[b] |
| Marbling score | Slight 50 | Slight 90 | Slight 70 |
| Ribeye area, $in^2$ | 10.33[a] | 10.64[a] | 9.30[b] |
| Quality grade | Select | Select [+] | Select [+] |
| Yield grade | 3.3 | 3.2 | 3.4 |

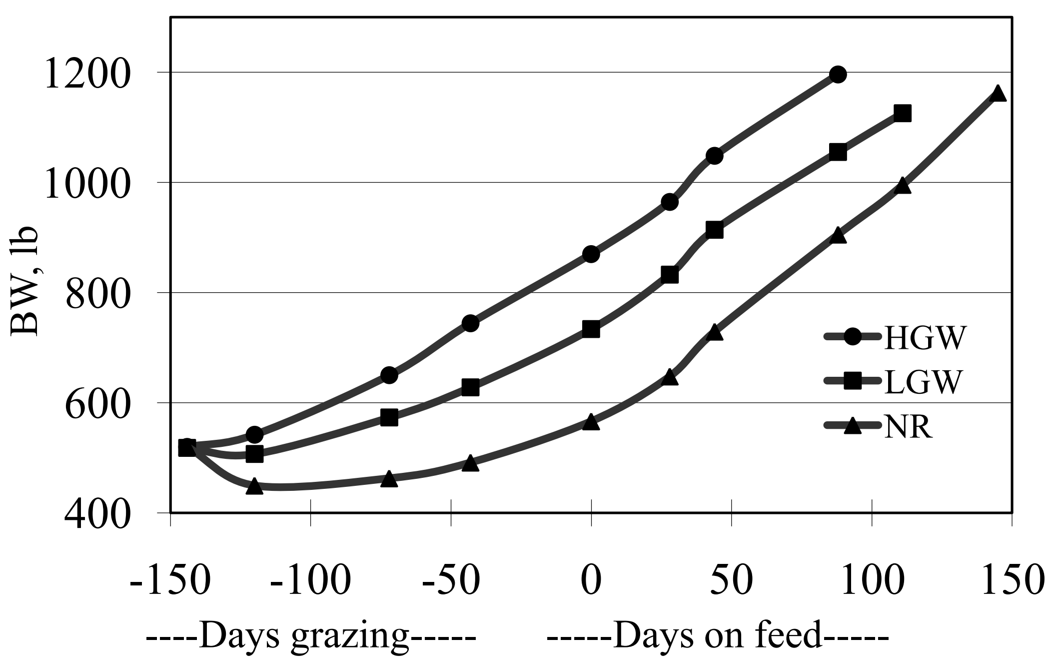
[1] Adapted from Sainz et al. (1995).
[a,b] Means with different superscripts are different $P < 0.05$.

Table 4. Effect of winter grazing treatment on feedlot performance and carcass characteristics [1]

| Item | Treatment[2] HGW | LGW | NR |
|---|---|---|---|
| | ----------Two-year mean---------- | | |
| Initial feedlot live BW, kg | 880[a] | 709[b] | 564[c] |
| Final feedlot live BW, kg | 1,218 | 1,141 | 1,193 |
| Days on feed | 87 | 113 | 160 |
| Feed DMI, lb/d | 23.1 | 22.0 | 22.0 |
| ADG, lb/d | 3.85 | 3.74 | 3.88 |
| Feed:Gain | 5.81 | 5.85 | 5.59 |
| Hot carcass weight, lb | 738 | 689 | 716 |
| Dressing percent | 60.5 | 60.0 | 60.4 |
| Backfat, in | 0.59 | 0.54 | 0.59 |
| KPH, % | 2.0 | 1.78 | 1.66 |
| Ribeye area, $in^2$ | 12.13 | 11.71 | 12.13 |
| Marbling score | Small[26] | Slight[90] | Small[13] |
| Yield grade | 3.25 | 3.11 | 3.20 |

[1] Adapted from Hersom et al. (2004).
[2] HGW = High gain wheat; LGW = Low gain wheat; NR= Native range. Mean live BW gain (lb/d) during winter grazing of HGW, LGW, and NR steers was, respectively, 2.65, 1.34, and 0.33.
[a,b,c] Means with different superscripts differ $P < 0.05$.

Figure 1. Steer live body weight during winter grazing and the subsequent feedlot period (Adapted from Hersom et al., 2004)



## Conclusion

When cattle of different production systems are compared at equal backfat endpoints, backgrounding system or previous nutrition generally had little effect on most important carcass characteristics particularly quality grade. Systems that incorporate nutritional restrictions may be appropriate for some cattle in defined production systems. Nutritional restrictions slow cattle growth during a defined period of time or take advantage of low-cost low-input feedstuffs. The decreased growth rate results in cattle that are often chronologically older at final harvest. Older cattle during the finishing period can be less efficient, may have decreased tenderness, and have limited export potential. The key is to make sure that any cattle that have been restricted nutritionally have the opportunity to recover that growth opportunity. Ultimately, the cattle type needs to be matched to the entire production system.

## Literature Cited


Coleman, S. W., and B. C. Evans. 1986. Effect of nutrition, age, and size on compensatory growth in two breeds of steers. J. Anim. Sci. 63:1968-1982.

Drouillard, J. S., C. L. Ferrell, T. J. Klopfenstein, and R. A. Britton. 1991a. Compensatory growth following metabolizable protein or energy restriction in beef steers. J. Anim. Sci. 69:811-818.

Ferrell, C. L., and T. G. Jenkins. 1998. Body composition and energy utilization by steers of diverse genotypes fed a high-concnetrate diet during the finishing period: I. Angus, Belgian Blue, Hereford, and Piedmontese sires. J. Anim. Sci. 76:637-646.

Fox, D.G., R. R. Johnson, R. L. Preston, T. R. Dockerty, and E. W. Klosterman. 1972. Protein and energy utilization during compensatory growth in beef cattle. J. Anim. Sci. 34:310-318.

Gardner, B. A., H. G. Dolezal, L. K. Bryant, F. N. Owens, and R. A. Smith. 1999. Health of finishing steers: Effects on performance, carcass traits, and meat tenderness. J. Anim. Sci. 77:3168-3175.

Hersom, M. J., G. W. Horn, C. R. Krehbiel, and W. A. Phillips. 2004. Effect of live weight gain of steers during winter grazing: I. Feedlot performance, carcass characteristics, and body composition of beef steers. J. Anim. Sci. 82:262-272.

Klopfenstein, T., R. Cooper, D. J. Jordon, D. Shain, T. Milton, C. Calkins, and C. Rossi. 2000. Effects of backgrounding and growing programs on beef carcass quality and yield. J. Anim. Sci.

Lawrence, T. L. J., and J. Pearce. 1964. Some effects of wintering yearling beef cattle on different planes of nutrition. J. Agric. Sci. 63:5-20.

McNeill, J. 2001. From the ranch to the feedlot – What works and what doesn't? Range Beef Cow Symposium. http://digitalcommons.unl.edu/rangebeefcowsymp/79 Accessed Feb. 12, 2009.

NRC. 1996. Pages 11-12 in Nutrient Requirements of Beef Cattle. 7th rev. ed. Natl. Acad. Press, Washington, DC.

Oltjen, J. W. 2008. Stocker programs, feedlot performance and carcass merit. Proc. Plains Nutrition Council. Pgs 36-44.

Phillips, W. A., J. W. Holloway, and S. W. Coleman. 1991. Effect of pre- and postweaning management system on the performance of Brahman crossbred feeder calves. J. Anim. Sci. 3102-3111.

Ridenour, K. W., H. E. Kiesling, G. P. Lofgreen, and D. M. Stiffler. 1982. Feedlot performance and carcass characteristics of beef steers grown and finished under different nutrition and management programs. J. Anim. Sci. 54:1115-1119.

Sainz, R. D., and B. E. Bently. 1997. Visceral organ mass and cellularity in growth-restricted and refed beef steers. J. Anim. Sci. 75:1229-1236.

Sainz, R. D., F. De l Torra, and J. W. Oltjen. 1995. Compensatory growth and carcass quality in growth-restricted and refed beef steers. J. Anim. Sci. 73:2971-2979.

Wertz, E., L. L. Berger, P. M. Walker, D. B. Faulkner, F. K. McKeith, and S. Rodriguez-Zas. 2001. Early weaning and postweaning nutritional management affect feedlot performance of Angus x Simmental heifers and the relationship of $12^{th}$ rib fat and marbling score to feed efficiency. J. Anim. Sci. 79:1660-1669.