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Feeding and Managing Cows on High Grain Diets

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INTRODUCTION

Increasing land prices, rising lease rates, restrictive grazing leases, intensified operations, as well as drought-related hay availability have all led to an increase in the use of alternative wintering programs for beef herds. While limit-fed grain rations have the potential to reduce wintering costs provided the programs are closely managed, additional herd management and feeding precision is needed to help ensure success. Several recent University studies have investigated different scenarios for limit-feeding high concentrate diets to heifers and adult cows. In addition, there have been several fact sheets, newsletters, and research reports discussing limit-fed high grain wintering rations for adult beef cows. All would suggest that if managed appropriately, limit-fed high grain wintering programs can be a low-cost alternative worth considering.

WHEN TO CONSIDER LIMIT-FEEDING

As discussed at previous Range Beef Cow Symposiums, there are considerable opportunities for reducing winter feeding costs by replacing a portion of the traditional forage-based winter ration with grain or other byproduct feeds (Wright, 2001; Maddox, 2001). Bunk feeding, or wintering cattle in drylot, may also create opportunities to utilize other feed sources and byproducts not normally considered, helping to reduce overall winter feed costs. This is especially true when hay prices are high. Deciding whether or not to limit feed is not only a question of comparing the price of corn vs. the price of hay. In addition to corn, there are several alternative forages and byproduct feeds (discussed by other presenters) that offer benefits in both feeding management as well as price. Other grains, including milo, wheat, barley, etc. can also be incorporated into limit-fed wintering rations. Typically, wheat and barley are blended with other commodities to help reduce the incidence of digestive upsets. Because of the increased potential for digestive upset, most recommendations are to limit wheat and barley to 50% or less of the total grain, and overall barley and/or wheat intake should stay below .5% of BW. Similarly, wheat midds are also blended with other grains and byproducts because of the potential for variation in starch content. High fiber, low starch byproduct feeds such as soybean hulls and beet pulp are beneficial in high grain, limit-fed diets, helping to dilute the overall starch content of the ration and improve feed handling and safety. Additional energy sources may also include drought-stressed, low test weight grains. Lack of irrigation water and localized severe weather may create opportunities to purchase drought-stressed or damaged (light test weight)

grains at a lower price. Often these grains, although having lighter bushel weights, have a feed values similar to or just slightly lower than average test weight grain.

The following discussion will focus primarily on corn as the major ingredient for limit-fed wintering rations. However, alternative feeds may provide opportunities for additional cost savings. Depending on the source and type of byproduct, there may be increased variability in feed quality. The best recommendation is to sample all feedstuffs for analysis, and develop rations to meet nutrient requirements and avoid problems.

When evaluating winter feeding programs, one of the easiest and perhaps quickest methods to determine whether or not to consider limit-feeding, is comparing corn vs. hay in providing the cheapest source of energy. The following example demonstrates this method, starting with current corn purchase price, and calculating an equivalent price for prairie hay based on energy values:

Table 1. Estimating an equivalent price/ton for prairie hay based on current corn price.

Calculating $/Mcal for corn:
Dry, shelled corn:
$2.60 / bu = $.0464 / lb = $92.86/ton as-fed
86% DM, 1.02 Mcals/lb
$.0464 ÷ .86 = $.054 / lb DM
$.054 ÷ 1.02 Mcal/lb = $.053 / Mcal NEm
Average hay typically = .55 Mcal / lb, so:
an equivalent hay price would be:
$.042 X .55 = $.029 / lb DM
$.029 X .88 = $.0255 / lb As-fed
= $51 / ton

This method provides a quick estimate for a comparable hay price to base your winter feeding decisions. However, limit-fed rations typically also include additional protein to meet the cow's increasing protein requirements during late gestation and early lactation. Table 2 provides another estimate of the value of grass hay using current prices for corn + soybean meal. The meadow hay used in this example is very similar to the quality of hay harvested in SE Wyoming (.58 Mcal NEm, 10% CP). The values shown in the body of Table 2 reflect the estimated hay price that would compare with a corn + soybean meal combination providing the same amount of energy and protein. These values for grass hay were generated for several different price combinations for soybean meal (across the top) and corn (left column). It should be noted that this is merely a starting point for evaluating winter feeding alternatives. Including a protein source in the pricing equation may have a noticeable effect on the estimated value of hay, especially when protein prices are high.

Table 2. Relative Prices for Native Hay, (body of table, $/ton) Using a corn/SBM mix balanced for equal NEm (.58 Mcal/lb) and CP (10%) where 1 lb of native hay = .4835 lb corn + .1153 lb SBM.

Corn,	Purchase price for Soybean Meal, $/ton								
$/bu	$140	$160	$180	$200	$220	$240	$260	$280	$300
$1.40	40.32	42.62	44.93	47.24	49.54	51.85	54.15	56.46	58.77
$1.60	43.77	46.08	48.38	50.69	52.99	55.30	57.61	59.91	62.22
$1.80	47.22	49.53	51.84	54.14	56.45	58.75	61.06	63.37	65.67
$2.00	50.68	52.98	55.29	57.60	59.90	62.21	64.51	66.82	69.13
$2.20	54.13	56.44	58.74	61.05	63.36	65.66	67.97	70.27	72.58
$2.40	57.58	59.89	62.20	64.50	66.81	69.11	71.42	73.73	76.03
$2.60	61.04	63.34	65.65	67.96	70.26	72.57	74.87	77.18	79.49
$2.80	64.49	66.80	69.10	71.41	73.72	76.02	78.33	80.63	82.94
$3.00	67.95	70.25	72.56	74.86	77.17	79.48	81.78	84.09	86.39

STUDIES EVALUATING LIMIT-FED WINTERING RATIONS

Several researchers have evaluated limit-fed grain diets used in wintering programs for adult cows as well as heifers. Pope et al. (1993) evaluated both energy concentration and degree of feed restriction with corn and corn silage based diets offered to weaned replacement heifers. Cattle on the higher energy diet had similar gains, despite having a greater feed restriction. Age of puberty was not affected by the limit-fed diets. Similarly, O'Neil et al. (1999) evaluated four wintering rations offered to replacement heifers, ranging from ad libitum prairie hay to limit-fed diets of either whole shelled corn, wheat middlings/soybean hull pellets, or barley malt sprouts. Winter gains were similar across all treatments.

Fewer studies have evaluated the use of limit-fed grain rations with adult cows. Brethour et al. (1990) evaluated the use of limit-fed rations as an alternative to summer grazing. Treatments included a traditional pasture grazing treatment with adequate forage vs. two drylot treatments offered milo and sorghum silage. Cattle in drylot received similar rations, however calves were weaned from one treatment after 13 days in drylot. After weaning, the limit-fed ration was reduced accordingly. Summer gains during the 93-day trial were similar, and pregnancy rates were highest for the drylotted, limit-fed cows that were early-weaned, indicating that summer drylot programs are feasible, and weaning the calf early can potentially improve rebreeding rates. More recent, peer-reviewed studies (Loerch, 1996; Tjardes et al. 1998) both indicate that limit-fed winter rations have the potential to reduce winter feeding costs while having minimal effects on cow weight changes and reproductive performance. Loerch (1996; Table 3) reported data from 3 trials involving limit-feeding adult cows. Rations used in all 3 trials varied only slightly from year to year, and contained very little forage, providing only 1.7 to 3.3 lbs of hay per day (Table 3). Cow performance was similar for limit-fed and free-choice hay treatments, although additional hay may have improved contentment. There were no differences in calving difficulty, however 2 of the 3 trials showed increased birth weights of calves born to limit-fed cows. Calf weaning weights and cow conception rates tended to favor the limit-fed cattle. Tjardes et al. (1998) also evaluated limit-fed diets, including supplemental fat as one of the

treatments. They reported no difference in cow weight change, reproductive performance, or calf weaning weights between the ad-libitum hay and limit-fed diets. A second study evaluated the effect of supplemental fat in limit-fed diets. Cattle on both treatments lost a similar amount of weight, and there was a numerical decrease in calving rate for the fat-supplemented cattle. These studies all indicate that high-grain, limit-fed diets are feasible and have minimal effects on cow performance, reproductive rates, and calf weaning weights. There still are additional questions as to whether supplemental fat may be beneficial in limit-fed diets.

Table 3. Limit-feeding corn to gestating beef cows, adapted from Loerch et al., (1996).

	Control, Ad-libitum Hay			3 year	Limit-fed corn diet			3 year
Item	Yr 1	Yr 2	Yr 3	Avg.	Yr 1	Yr 2	Yr 3	Avg
Ration								
WS Corn, lb					10.4	10.8	12.(	11.3
Hay (10% CP), lb	32.2	29.1	29.5	30.3	2.6	1.8	2.2	2.2
Supplement*, lb					2.6	2.6	2.2	2.5
Total	32.2	29.1	29.5	30.3	15.6	15.2	17.(	15.9
Animal Performance								
No. of cows	41	41	41	41	29	29	30	29.3
Weight change, lb	-31	-51.7[a]	-136.6[a]	-73.1	4.4	-117[b]	-48.5	-53.7
Calf Birth Wt, lb	94.6[a]	95.9	97.2[a]	95.9	103.8[b]	99.4	105.4	102.9
Calf Wean Wt, lb	631[a]	585	628	615	674[b]	590	642	635.3
Conception rate, %	95.1	85.4	73.2[c]	84.6	90	93.1	90.(	91.0

[ab] Treatment means differ within year (P<.05).

* 36% Protein supplement with 3.6% Ca and 1% Phos (As-fed).

** Trial was conducted from November through Mid-April.

A recent study at the University of Wyoming attempted to evaluate the effect of prepartum supplemental fat when included in limit-fed wintering rations (Table 4; Small et al., 2003). All cows were adapted to the limit-fed control ration prior to the study, and supplemental fat was fed for an average of 60 days prior to calving. After calving, all cows were managed together and again received the control limit-fed ration.

Postpartum cow weight and body condition scores (BCS), taken 19 days after calving, (Table 5) were similar for both prepartum diet treatments. Final cow weight and BCS were also similar. Feeding a diet containing 4.63 % supplemental fat prepartum had no affect on calf birth weight. Percentage of cows exhibiting estrus within seven days of synchronization was 92.31 % for the control and 94.67 % for supplemental fat treatments, and first service conception rates were also similar (67.95 % vs 66.67 %) for control and added fat groups. Although a control, free-choice hay group was not included in this study, the data suggest that prepartum supplemental fat in limit-fed high grain diets does not affect cow performance, calf birth weight, or subsequent rebreeding success. Supplemental fat may have the potential to benefit the calf, as discussed by Hess et al., also in this proceedings.

Table 4. Intake and Diet Composition of Limit-Fed Wintering Rations fed 60 days prior to calving.

Item	Control	Added Fat
Ingredients, lb/day (as-fed)		
Millet Hay	10.11	10.11
Corn	14.07	11.03
Protein/Mineral Supplement, (Control Diet)	.91	- -
Mineral Supp, (Added Fat Diet)	- -	.50
Protein/Fat Supplement, (Added Fat Diet)	- -	3.20
Intake, lb/day	25.09	24.84
Nutrient Composition, % DM Basis		
Dry Matter, %	87.73	88.47
Organic Matter, %	92.89	92.37
Crude Protein, %	10.28	10.15
TDN, %	2.69	4.63
Fat, %	75.36	75.14
ADF, %	16.64	19.87
NDF, %	43.15	44.59

Table 5. Cow weight change, body condition scores and reproductive performance for cows receiving control or added fat diets 60 d. prior to calving.

	Treatment			
Item	Control	Added Fat	SE	P-Value
Cow Age	6.13	6.24	0.230	0.74
Initial Cow Wt./lbs. [a]	1333	1333	13.4	0.99
Initial Cow BCS	5.08	5.05	0.056	0.73
Days on diet [b]	60.09	61.07	1.90	0.71
Birth Wt.	91.37	92.87	1.66	0.52
18d Postpartum Wt. [c]	1333	1325	14.8	0.69
18d Postpartum BCS	5.49	5.50	0.076	0.95
Final Wt. [d]	1276	1272	13.7	0.84
Final BCS	5.34	5.39	0.07	0.63
Response to Synchronization [e]	92.31	94.67	2.842	0.56
1st Service Conception [f]	67.95	66.67	5.398	0.87

[a] Taken at the end of adaptation period.
[b] Average days on treatment; beginning of trial to calving.
[c] Cow weight and BCS taken approximately 18 d postpartum.
[d] Final cow weight and BCS taken prior to estrus synchronization.
[e] Percentage of total cows exhibiting estrus and artificially inseminated following synchronization.
[f] Percentage of total cows pregnant from 1st service, determined by day 30 ultrasound.

These studies indicate that limit-fed wintering diets can be successfully developed to provide a similar level of nutrition as compared to traditional, free-choice, forage-based wintering rations. In certain situations, these grain-based diets can reduce overall winter

feeding costs. Studies designed to evaluate limit-fed, grain based diets have resulted in similar cattle performance, reproductive success, and calf gains. However, few studies discuss the potential for increased variability in weight gain in limit-fed diets. Feeding management and close observation are also key ingredients in successful limit-fed high concentrate wintering rations.

HERD MANAGEMENT

The economic decision of whether or not to utilize high grain diets may be somewhat straightforward, based on current grain and hay prices; however, the additional facilities and management required to feed and manage cattle on limit-fed high grain diets requires more planning. Compared to traditional winter feeding methods of providing free-choice hay, limit fed rations require additional management and facilities that must also be considered.

Diets and Cow Requirements. Because nutrient requirements increase during the last trimester of gestation, as well as early lactation, (Figure 1), limit-fed diets must also be formulated for at least two periods – prepartum, or prior to calving, and early lactation. Also, the mineral program may need to be adjusted to reflect the lower calcium levels associated with high grain diets. Consider mineral formulations that are higher in calcium, much like to feedlot minerals. Rough guidelines for limit-fed high grain diets are provided in Table 6 (Lalman). Actual amounts of grain, protein and forage are dependent on forage quality as well as animal requirements. In addition, the level of feed restriction, and relative amounts of forage and grain are dependent on feeding success, animal response to the limit-fed diets, as well as feeding management.

Figure 1. Estimated daily energy requirements (expressed as lbs of TDN) during a 12-month production cycle.

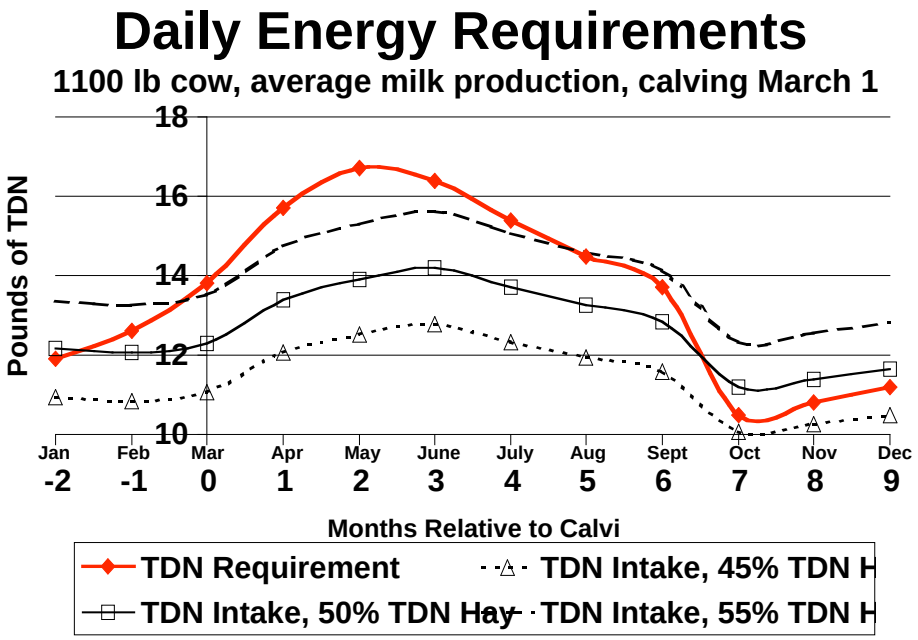

Table 6. Example limit-fed grain rations for wintering beef cattle (Adapted from Lalman)

	Amount to be fed		
Stage of Production	Corn	38 to 44% Protein Supp.	Long stemmed grass hay
Gestating	.75% of BW	2 lbs/day	.5% of BW
Lactating, avg. milk	1.0% of BW	3 lbs/day	.5% of BW
Lactating, high milk	1.1% of BW	3.5 lbs/day	.5% of BW

Feeding Management. When starting cattle on a limit-fed grain diet, work them up slowly. Offer 3 to 4 lbs of grain plus free choice hay at first. Once cattle are consuming all of the grain, increase the grain slowly, and the increases in grain should be in 1 lb/head increments or less. When the desired daily level of grain is reached, begin removing the hay from the ration, eventually reducing the daily amount down to desired levels. While the cattle are on the limit-fed, high grain diet, it is extremely important to feed accurately and at the same time every day. If a feeding is missed or extremely late, consider feeding additional hay to cushion the effect and avoid any digestive upsets. Ionophores can be very beneficial, improving feed efficiency while also reducing the chance of digestive problems. Also, the safety factor of the diet may be improved by increasing the coarseness of the hay, or feeding long-stemmed hay.

When limit-fed diets are introduced, consider that cattle behavior will be dramatically affected. Cattle on limit-fed rations typically have very aggressive behavior at the bunk, consuming their total daily ration in as little as 20 to 30 minutes. Therefore, there needs to be adequate bunk space (most recommendations are 24" to 36"). When cattle eat quickly, the herd has plenty of free time to pace the fences, establish pecking order, and crib. This is especially true during the first few weeks as they "adapt" to their new diet. If the cattle have difficulty adapting to the diet, or they seem to be extremely restless even after they have had time to adapt, increasing the amount of hay may improve contentment. During the winter feeding period, timid cows may continue to be pushed away from the bunk. Because cows can become aggressive, it may be a good idea to sort the herd into 2 or 3 groups. Some sorting groups to consider include: 1) bred heifers, young and thin cows, and 2) mature cows in good condition. You may choose to limit-feed only one of these groups, and not the entire herd.

During the winter, monitor the cattle closely, and make appropriate adjustments in the diet. Try to avoid the temptation to overfeed. When feeding cattle on limit-fed programs, the person delivering the feed can often be overly generous, especially when the cattle seem hungry. Continue to monitor condition of the cows closely. You may also find that all cows may not adapt to the grain diet, and some may need to be removed and offered a more traditional hay diet. Success of the limit fed, high grain diets is not only reducing feed costs. Success also requires good feed management, consistent feed intake, low incidence of digestive upsets, and uniform weight gain for all cows.

Several reports indicate that limit-feeding programs have the potential to reduce winter feed costs without affecting herd rebreeding rates. Limit-fed cattle appear to cycle

and conceive the same as hay-fed cattle in similar body condition. Studies have also indicated a small increase in birth weights, however none have reported any differences in calving difficulty. Finally, Limit-fed, high grain diets can work successfully in a variety of situations, as long as feeding is managed closely, and cow condition is checked regularly.

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