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Beef Cattle Feed Efficiency

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Introduction

Feed efficiency is currently a very popular topic among cattle producers and researchers. However, this is not a new concept. Researchers have been studying feed efficiency for 40 years. However, changing dynamics in agriculture have brought more feed efficiency research to the forefront. The combination of decreasing acres available for crop production, an increasing world population, increased utilization of grain for fuel, increased input costs (fuel, transportation, and fertilizer) and an increase in feed costs (grain and forage) are some of the key factors that highlight the changing dynamics of agriculture. Additionally, the recent drought in much of the United States has further reduced the available feed supply driving feed costs dramatically higher. Historically, feed costs have represented 50-70% of the cost of production for beef enterprises. As corn prices approached and exceeded $7 per bushel, feed costs were nearly 80% of the costs in many feedlot operations. In 2011, an improvement of 10% in feed efficiency in the entire feedlot sector would reduce feed costs $1.2 billion.

Measures of Efficiency

Feed Conversion Ratio (FCR): Feed conversion ratio is the ratio of dry matter intake to live-weight gain. A typical range of feed conversion ratios is 4.5 -7.5 with a lower number being more desirable as it would indicate that a steer required less feed per pound of gain. Feed conversion ratio is a good measure for monitoring or describing feedlot cattle performance; however, it is not a great measure to select for. Feed conversion ratio is correlated to growth rate. Selecting for improved FCR would result in an increase in genetic merit for growth which would lead to increased mature cow size which would ultimately increase the feed costs for the cow herd.

Residual Feed Intake (RFI): Residual feed intake is an alternative measure of efficiency. It is the difference between actual intake and predicted intake based on an animal's body weight, weight gain, and composition. A negative value for RFI is good as it would indicate that a steer consumed less feed than was predicted for his weight, gain, and composition. An advantage of RFI is that it is independent of growth and mature size. Because it is independent of growth, research has investigated selection based off of RFI.

Residual Gain (RG): Residual gain is the difference between actual gain and predicted gain based on an animal's body weight, intake, and composition. A positive value for RG is good as it would indicate that a steer gained more than was predicted for his weight, intake, and composition. This measure is correlated to growth; thus, it may be better suited for identifying superior feedlot cattle and not as good for selecting replacement females.

Current Status of the Industry

Although feed efficiency has been studied for decades and feedlot profitability is clearly impacted by feed efficiency, the beef industry is well behind the competition. Feedlot cattle typically have FCR at or above 6:1, swine are < 3.5:1, poultry are < 2:1, and catfish are nearly 1:1. In fact, poultry have improved feed efficiency by 250% in the last 50 years. However, the beef industry has made minimal to no improvement during the last 30 years. Why are cattle less efficient? Unfortunately, beef cattle will never be as efficient as monogastric animals. Ruminant animals consume a higher fiber diet and through rumen fermentation energy is lost as methane. Also, because of their larger size, cattle have a much higher maintenance requirement. However, this does not explain why we have made little to no improvement. The answer to that is simple; we have not selected for feed efficiency. Identifying superior individual cattle requires that cattle be fed individually. This requires expensive, labor-intensive facilities and feeding cattle individually removes the social interaction that cattle experience when fed as a group in a large pen. Also, it is difficult to compare cattle that are at varying compositions.

Technological Advances Facilitate Efficiency Research

Major technological advances in feed intake measurement now allow cattle to be maintained in a pen environment yet have individual intake recorded. Technology, such as the GrowSafe® system, utilizes radio frequency ID tags and a bunk that is on scales. Only one animal at a time is able to eat. An antenna in the bunk reads the radio frequency ID tag and records the weight of the feed in the bunk when the animal puts its head in the bunk and when it removes its head from the bunk. Several universities and private businesses now have technology similar to this to record individual feed intake. The use of ultrasound allows repeated measurements of 12th rib backfat, rump fat, marbling and ribeye area. When calculating RFI and RG, composition is often included as it accounts for some of the variation in intake and/or gain.

Cowherd Efficiency

Much of the research thus far has focused on identifying cattle that are efficient in feedlots on high energy (grain) diets. However, identifying efficient females to retain in the herd may deserve as much or more attention. Approximately 70% of feed resources utilized in the beef industry are for the cowherd and about 70% of that feed is for maintenance. This means that nearly half of all of the feed used in the beef industry is just to maintain the cowherd. Several definitions have been proposed for cow efficiency. Beef cow efficiency measures often include pounds of calf weaned and intake. Reproductive success and longevity obviously can have a dramatic impact on the bottom line of a cow-calf operation. More work is needed to evaluate the effects of selecting for various feed efficiency measure on reproductive success, cow productivity and longevity.

Feedlot vs. Cowherd Efficiency

Although the cow-calf operations and feedlot operation are often considered separate entities, we can’t have one without the other. Both cow-calf managers and feedlot operators are interested in improved efficiency. Ideally, selection for improved feedlot efficiency will improve cow efficiency. However, this may not be the case. Feedlot cattle consume high-energy, grain-based diets and the cowherd consumes moderate to low-energy, forage-based diets. Intake is not regulated by the same mechanisms for these different diet types. There are factors related to maintenance energy requirements that are similar in both the growing/finishing steer and the mature cow. Further research is still needed to determine the relationship between grain and forage efficiency and between the feedlot and cowherd.

Summary

Limited feed supplies and high feed prices have increased producer awareness of feed efficiency recently. Feed efficiency has been studied for decades yet minimal progress has been made in the beef industry. Recent advances in technology now allow for individual feed intakes to be recorded on cattle fed in large groups. Research has largely focused on identifying superior cattle during the finishing phase when cattle are fed grain-based, high-energy diets. However, the cowherd consumes a lower energy, forage based diet. Further research is needed comparing efficiency measure on high-energy, grain diets and low-energy, forage diets. It is important to understand the impacts of selecting for feed efficiency on cowherd reproduction, productivity, and longevity.

Selection for Improved Feed Efficiency

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There is no doubt that feed costs are a substantial portion of the total costs associated with growing animals. Anderson and others (2005) estimated feed costs accounts for 66% of costs in calf-fed systems and 77% in yearling finishing systems. The ability to improve the utilization of nutrients has tremendous potential to improve profitability. Fox and others (2001) estimated that a 10% improvement in performance (gain) would increase profit by 18%, while a 10% improvement in efficiency could improve profit by upwards of 43%. Weaber (2011) estimated that a 10% improvement in feed efficiency (assumed to be a 2 lb. reduction in RFI) across the entire feedlot sector would equate to $1.2 Billion in reduced feed costs.

Although progress has been made in feed conversion (F:G) over the past decade, it has been minimal relative to the progress that other species, such as poultry, have made (250% increase in feed efficiency since 1957). Iowa closeout data suggests a 0.047 lb./yr. decrease in F:G from 1978-1992 and from 1988-2002 midwestern closeout data suggests the change is slightly less (0.033 lbs./yr. decrease). Advancements in dietary regimes and technology (implants and feed additives) have made substantial differences, but direct genetic selection for efficiency remains an untapped source of potential improvement.

What Role Does Genetics Play?

Efficiency metrics are at least moderately heritable and thus genetic change through selection is feasible. Table 1 below depicts the heritability (on the diagonal) and genetic correlations (on the off diagonal) of several feed efficiency metrics. Table 2 shows the expected response to selection using several selection criteria. From table 2 it is clear that an economic index approach to selection is the most desirable.

Table 1. Genetic parameters for feed efficiency metrics1.

	ADG	DMI	RFI	G:F
ADG	0.26	0.56	-0.15	0.31
DMI		0.40	0.66	-0.60
RFI			0.52	-0.92
G:F				.027

1Adapted from Rolfe et al. (2011).

Table 2. Expected response (selection intensity*lbs) to selection based on several criterion1.

Selection Criterion[2]	Direction	DMI Response, lbs.	Gain Response, lbs.
DMI	Down	-125.0	-11.91
GAIN	Up	+57.98	+16.54
G:F	Up	-60.63	+5.29
I_1	Down	-98.33	+4.19
I_2	Down	-84.88	0
I_3	Down	-27.34	+11.91
I_4	Down	0	+16.98

1 Adapted from Rolfe et al. (2011).

2 DMI= Dry matter intake; GAIN = Weight gain; G:F = Gain to feed ratio; I1 = Phenotypic RFI; I2 = Genetic RFI; I3= Economic index DMI and Gain; I4=Economic index of Gain and RFI.

Existing EPDs

Some EPDs do currently exist to select for partial efficiency. Examples of those are detailed below.

	Bull A	Bull B
Residual average daily gain	-0.1	0.05
Days to finish	15	10
Maintenance energy	0	10

Residual average daily gain (Angus)- Calves sired by bull B should gain 0.15 pounds per day more when fed the same amount of feed during the post weaning phase.

Days to finish (Gelbvieh)- Calves sired by bull B would spend 5 fewer days on feed to reach a constant fat endpoint.

Maintenance energy (Red Angus)- Daughters from bull B should require 10 Mcal/month less energy for maintenance. If average hay quality is 0.86 Mcal/lb. this equates to 11 lb. less forage per month.

Even though some EPDs do exist for components of efficiency, feed intake phenotypes are expensive to collect and thus for the foreseeable future, wide-spread collection of individual intake data in the seedstock sector will remain sparse at best. Furthermore, selection should focus on profitability of an operation thus a bio-economic index approach to multiple-trait selection is advised. The most exciting thought of selection tools for fed intake/efficiency is the ability to optimize intake and weight gain (adjusted for compositional differences) to lead to increased profitability instead of selecting for extremes in either output (gain) or input (intake).

Selection Methods for Efficiency

A reasonable question is the need to actually measure individual animal intake to make progress relative to efficiency. Feed efficiency of the beef life cycle on an average dam basis can be expressed as follows (adapted from Dickerson, 1970):

[Dam Weight*Lean Value of Dam + No. Progeny*Progeny Weight*Lean Value of Progeny]

- [Dam Feed*Value of Feed for Dam + No. Progeny*Progeny Feed*Value of Feed for Progeny].

The output from harvesting the dam (or fraction of the dam accounting for death loss) and from harvesting progeny (accounting for death loss) are represented in the revenue component above. The feed cost component accounts for the input of feed energy. The number of progeny per dam is in both components. Consequently, increasing the number of progeny per dam will increase efficiency. This can be done through direct selection (heifer pregnancy, reproductive longevity), heterosis, or improved reproductive management. Feed intake does not need to be measured to make this improvement (Nielsen et al., 2012).

Improvements in efficiency can also be made considering a single animal without the need to measure feed intake. Conceptually feed intake can be partitioned into: 1) feed required to meet maintenance requirements (**M**, basal metabolism, tissue repair, thermal regulation, locomotor activity, etc.) or the energy required for keeping body weight constant; 2) feed required to create new product (**P**, e.g., growth, milk, new offspring); and 3) feed that goes unused (**U**, waste products). Following Nielsen and others (2012) in a report to the Beef Improvement Federation, efficiency for a growing calf can be shown as:

Calf Weight Gain * Calf weight value - [FeedM + FeedP + FeedU] * Feed value

From this, Nielsen and others (2012) suggest that for a pair of calves with the same start and end weights but with one animal gaining weight more quickly (fewer days and less maintenance) the faster growing calf would be more efficient.

From a total life-cycle perspective, maintenance energy costs are estimated to be about 70% of the total energy intake in the beef production system. Thus a primary goal must be to decrease maintenance energy requirements while not reducing output. This means that profitable selection decisions must contemplate multiple traits simultaneously. Using selection index values will be very beneficial to achieve the overall goal of improved profitability. If constructed correctly, multiple-trait index tools can account for antagonisms that may exist between feed intake and other economically relevant traits, including cow-herd centric traits.

We cannot explain all the variation in individual-animal intake from knowledge of body weight maintained and level of production. Animals differ in their ability to utilize feed stuffs. Consequently, the ability to measure feed intake and thus develop genetic selection tools to select directly on feed utilization is beneficial, although costly. Below are definitions of common metrics of feed efficiency (Dahlke et al. (www.iowabeefcenter.org/Docs_cows/IBC41.pdf).

Comparison of feed efficiency terms

Method	More Desirable	Less Desirable	Difference
Raw F:G – Raw Feed Conversion: usually on dry matter basis (lbs feed/ lb of gain)	Lower values Example: 4.5 lbs	Higher values Example 7.5 lbs	Example: 3.0 lbs of feed
Adj. F:G – Adjusted Feed Conversion: usually on dry matter basis (lbs feed/lb of gain)	Lower values Example: 4.5 lbs	Higher values Example: 6.5 lbs	Example: 2 lbs of dry matter
RFI – Residual Feed Intake: usually on dry matter basis	Negative values Example: -1.7	Positive values Example: +1.5	Example: 3.2 lbs of feed
R-ADG – Residual Average Daily Gain: usually on lbs gained per day	Positive values Example: +0.86	Negative values Example: --.63	Example: 1.49 lbs of average daily gain
Adj. DMI – Adjusted Dry Matter Intake: should be on dry matter basis	Negative values Example: -0.9	Positive values Example: +0.8	Example: 1.7 lbs of feed

Why a Genomics Approach?

Genomic information, in the form of Single Nucleotide Polymorphisms (SNP), has always held the promise to increase the accuracy of Expected Progeny Differences (EPD). This promise has finally been realized for those breeds that incorporate this information into their EPD calculations. For those breeds that have not, genomic information for complex traits (those controlled by many genes) is available to producers in a disjoined context and is published separately from EPD.

One key advantage to genomic predictors (i.e. Molecular Breeding Values (MBV)) is that this information can be garnered early in the life of the animal thus enabling an increase in the accuracy of EPD particularly on young animals, which have not yet produced progeny. However, the benefit of the inclusion of genomic predictions into EPD estimates is proportional to the amount of genetic variation explained by the genomic predictor (Thallman et al., 2009).

Marker-Assisted EPD were first estimated for carcass traits and then evolved to other production traits for which EPD already existed. This is due to the need for phenotypes to train (process of developing prediction equations using significant SNP) the genomic predictions. Consequently, genomic tests for "novel" traits such as different measures of efficiency or disease susceptibility require a significant effort in order to build large resource populations of animals with both phenotypes and genotypes. These two particular suites of traits (feed efficiency and Bovine Respiratory Disease) are currently the focus of two integrated USDA projects. In these two cases, use of genomic tools could have an economic advantage over routine collection of very costly phenotypes.

The underlying question commonly asked by producers is “does it work?”. It is critical to understand that this is not a valid question, as the true answer is not binary (i.e. yes or no). The important question to ask is “how well does it work?”, and the answer to that question is related to how much of the genetic variation the marker test explains. The magnitude of the benefits will depend on the proportion of genetic variation (%GV) explained by a given marker panel, where the %GV is equal to the square of the genetic correlation multiplied by 100.

Combining these sources of information, molecular tools and traditional EPD, has the potential to allow for the benefits of increased accuracy and increased rate of genetic change. Increased rate of genetic change can occur by increasing the accuracy of EPD, and thus the accuracy of selection, and by decreasing the generation interval. This decrease in the mean generation interval could occur particularly for sires if they are used more frequently at younger ages given the increased confidence in their genetic superiority due to added genomic information.

Figures 1 and 2 illustrate the benefits of including a MBV into EPD (or Estimated Breeding Value (EBV) which is twice the value of an EPD) accuracy (on the BIF scale) when the MBV explains 10 or 40% of the genetic variation (GV), which is synonymous with R2 values of 0.1, and 0.4. The darker portion of the bars shows the EPD accuracy before the inclusion of genomic information and the lighter colored portion shows the increase in accuracy after the inclusion of the MBV into the EPD calculation. As the %GV increases, the increase in EPD accuracy becomes larger. Additionally, lower accuracy animals benefit more from the inclusion of genomic information and the benefits decline as the EPD accuracy increases. Regardless of the %GV assumed here, the benefits of including genomic information into EPD dissipate when EPD accuracy is between 0.6 and 0.7. On the other hand, when %GV is 40, an animal with 0 accuracy could exceed 0.2 accuracy with genomic information alone. This would be comparable to having approximately 4 progeny for a highly heritable trait or 7 progeny for a moderately heritable trait. It should be noted that although a SNP panel that only explains 10% of the GV would be considered poor for weight traits, if phenotypes do not exist, a panel of this efficacy would be beneficial.

Figure 1. Increase in accuracy from integrating genomic information that explains 10% of the genetic variation into Estimated Breeding Values (EBV).

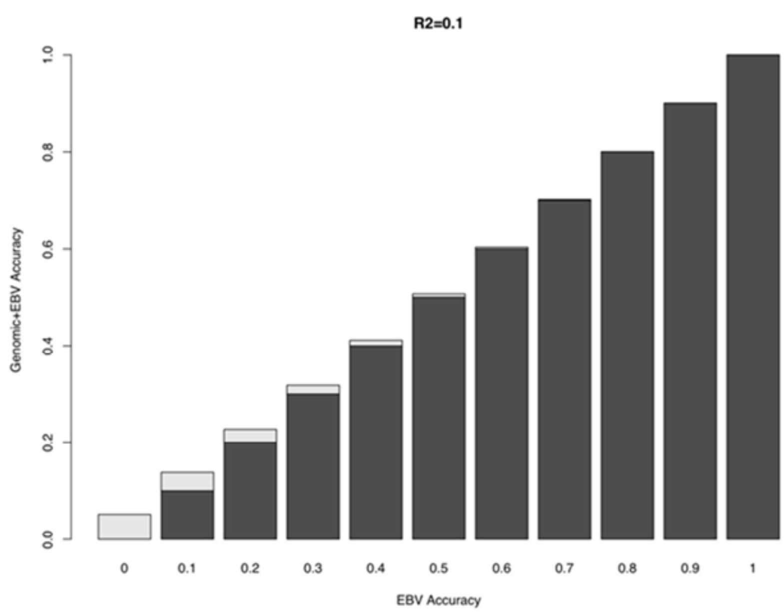
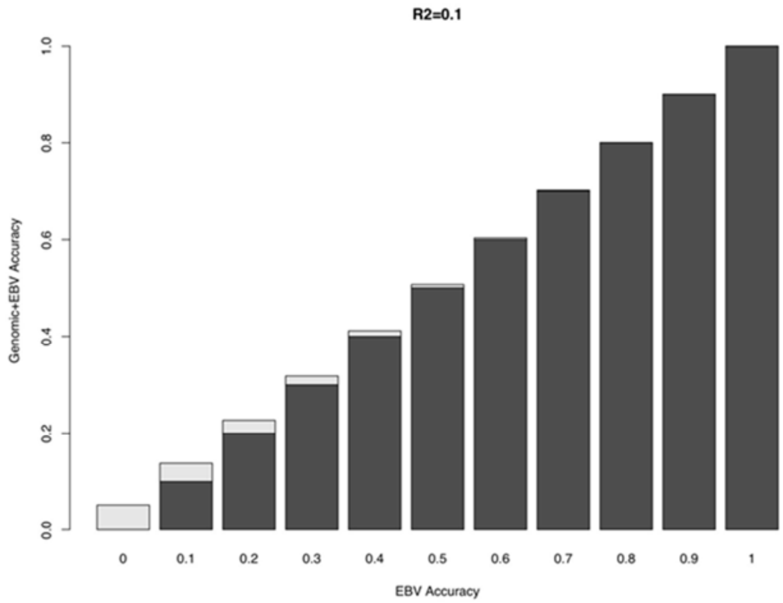


Figure 2. Increase in accuracy from integrating genomic information that explains 40% of the genetic variation into Estimated Breeding Values (EBV).



Current efforts

A current multi-institutional integrated effort to develop and deploy selection tools to improve the efficiency of feed utilization in growing cattle is currently underway (www.beefefficiency.org). Since feed intake phenotypes are expensive to measure and a genomics approach is logical, this project seeks to develop genomic predictors for feed intake/efficiency using dense SNP panels (50,000 and 770,000 SNP). The project also plans to dissect regions of the bovine genome that harbor genetic variants that explain relatively large portions of the genetic variation for these traits in an effort to discover genes that control the underlying mechanisms that make animals more efficient. To do this requires the collection of feed intake records from thousands of animals that are genotyped with either the 50K or 770K SNP assays across multiple breeds in order to develop genomic predictors that are accurate and robust across cattle populations.

A unique, and critical, component of the current project is the integrated nature of the research program. One part of the integrated component is a large field demonstration that includes 24 seedstock partners from 7 breeds and one large commercial ranch. From this field demonstration resource, sires from collaborating seedstock herds will generate progeny that will be genotyped and have individual feed intake collected such that research findings can be evaluated using producer collaborators. Furthermore, half-sib replacement females will be evaluated based on reproductive performance and estimates of the relationship between feed efficiency in growing animals and reproductive success will be estimated.

The ability to select for improved feed utilization is exciting and will be enabled by genomic tools. However, improvement of efficiency is inherently a multiple-trait issue and thus the development of indexes and utilization of them to select for the most profitable animals in critical.

Beef Cow Herd Efficiency

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Efficiency can be generally defined as the extent to which time, effort, or cost is well used for the intended task or purpose. And efficiency can be a measureable concept, in which it is typically quantified by determining the ratio of output to input. Overall the United States Beef industry, has accomplished major advances in efficiency by producing more pounds of beef with decreasing cow numbers. But while these advances have been important, our resources are limited and the industry must continue to find additional ways to capture efficiency. When defining efficiency for the beef cow herd, there can be two types of efficiency to address: 1) biological and 2) economical. While these two types are related to each other, they are not identical and it can be difficult to achieve both within the cow herd.

Biological Efficiency

In a cow-herd, there can be several measures, which can be used to determine biological efficiency. In the feedlot sector of the industry, the standard measure is feed efficiency (pounds of feed per pound of gain). Similar to the feedlot sector feed costs represent the largest portion of expenses in a cow-calf operation, thus is important for cows to be able to efficiently convert feed into pounds of weaned calf. Therefore, some have argued one way to evaluate this efficiency is to determine the ratio of calf body weight to its dam body weight. However, there are some issues with using this measure of efficiency for selection. First this measure assumes the same input in feed intake. In addition, milk production influences both parts of this equation. But most importantly, this measure does not include reproductive efficiency of the cow or in general the cow herd. While feed efficiency is important, we cannot underscore the importance of reproductive efficiency. This is a biological system, so it should be no surprise that these two measures of efficiency are related. Therefore, a measure of biological efficiency of the cow herd, which includes both of these measure, is pounds of weaned calf per cow exposed. This value reflects both weaning weight and percent calf crop weaned in the herd. A further analysis in Table 1 shows that a 1% change in percent calf crop is approximately equivalent to a 5 lbs change in weaning weight.

Table 1. Calculation of pounds of calf weaned per cow exposed.

	Average Weaning Weight of All Calves (lbs)			
% Calf Crop	450	500	550	600
	Pounds of Calf Weaned per Cow Exposed[a]			
75	338	375	412	450
80	360	400	440	480
85	382	425	467	510
90	405	450	495	540
95	427	475	522	570
100	450	500	550	600

[a]Calculated by multiplying % calf crop by average weaning weight

There are several major factors, which go into this measure of efficiency of the cow herd. When you take a closer look at the percentage of calves weaned per cow exposed in the calculation this the measure of reproductive efficiency. Of course this includes those factors, which may have prevented the cow from conceiving such as body condition score at calving, bull mating capability, implementation of artificial insemination program, and development of heifers. But this part of the equation also includes those factors, which may impact calf death loss such as abortions, diseases, dystocia, health issues at calving, and post-calving death losses. The second component to this equation is the pounds of weaning weight. Again several management factors determine this part of the equation. No doubt genetics play a major role in determining weaning weight from the growth potential of the calf to milk production of the dam as well as the decision to introduce heterosis through a cross-breeding program. Management factors such as age of calf at weaning, growth promoters, time and duration of calving season, and herd health also play a major role. Again nutrition cannot be overlooked because feed supply can impact growth rate as feed available influences the calf body weight either by milk and/or forage available.

Where does cow size fit into this discussion of biologically efficiency? The cow herd's feed requirements amount to 50-75% of the annual maintenance costs for the herd. Feed maintenance requirements for a cow are based on body weight and feed amounts increases as cow body weight increases. Thus stocking density could be increased and winter feed amounts per cow could be decreased. While this biological phenomenon would potentially advocate for a smaller cow, there are some concerns with selecting for small cow size. A smaller cow could result in lighter weaning weights and would increase the total amount of feed needed for the cow herd. In the end, when considering management changes to maximize biologically efficiency, a producer must consider the economic efficiency of such a decision. For example, in order to make up for the increase in feed costs, larger cows must return more income, either by being more reproductively efficient or by weaning heavier calves.

Economic Efficiency

The key aim of a cow-calf producer is that a cow should produce a live calf. While this is desired goal for an individual cow, it usually is not a realistic economic goal because beef cows are managed in herd or groups and typically under diverse set of environments. The average cow herd should expect at least an 80-85% calf crop and while a higher percent calf crop as the goal. However, the ultimate question is can you afford feed, labor, and other costs associated with these improvements.

For example, a majority of producers will develop their own replacement heifers. Studies have demonstrated that if heifers do not achieve 65% of their maturity at puberty, this can result in negative consequences in conception rates and this ultimately reduces the percent calf crop. Again, the largest expense in developing heifers is feed costs, while this may optimize performance in the short-term, is it the most beneficial in the long term? Research by Dr. Roberts and others as USDA ARS Fort Keogh Research Station have investigated the effects of rearing heifers under caloric restriction and the long-term consequences on longevity and productivity (Roberts, 2011). Should we be more focused on longevity in these current conditions? Cows that produce regularly under a low-cost feed environment will remain in the herd for a long period of time. Over time, this can reduce replacement rate, which usually lowers annual cow cost. Research at Fort Keogh has reported that restricted heifer development/winter finding improved efficiency, reduced amount of feed per pregnant heifers ($24/heifers), which resulted in 200-300 lbs less feed per winter ($9-12/year). Further results indicate that offspring have increased efficiency as cows altering partitioning of nutrient utilization (increased body condition score and decreased calf weight) that results in increased retention of cows beyond 5 years of age. This type of system suggests these cows may be drought tolerant. Again, in uncertain times having a cows which can tolerate drought and limited feed may be a way of achieving economic efficiency, but even the results of this project suggest you will not optimize biological efficiency.

The general assumption is increasing the weaning weights of calves can lower the breakeven price required to cover productions. As Table 2 shows that at a given calf crop percentage and an annual cow costs, the increments in weaning weight have a decreasing economic advantage. Weaning weight then should be increased in a herd as long as it is cost effective. For example, the management decision of creep feeding may need to be yearly management decision and only implemented if the cost of gain is profitable.

Table 2. Changes to breakeven prices with 50-lb increments in weaning weights (assumes an 80% calf crop and a $300 annual cow cost).

Weaning Wt (lbs)	Lbs of Calf Weaned	Breakeven Price (cwt)	Change in Breakeven Price (cwt)
350	280	$107.14	$13.39
400	320	$93.75	$10.42
450	360	$83.33	$8.33
500	400	$75.00	$6.82
550	440	$68.18	$5.68

Adapted from Field, 2007

Beyond the cow, other factors can affect economic efficiency. For example improper feed storage and delivery can be costly to a cow-calf operation. If a producer is losing almost 50% of the feed before the feed is consumed by the cow there is opportunities to improve efficiency. Opportunities may also exist to improve efficiency through a more intensive grazing system. And a closer look at some smaller Midwest cow-calf operations through Standard Performance Analysis in the past have suggested some operations it would be more advantageous to purchase hay than it was to spend the money on equipment and labor to harvest themselves. In order to achieve economic efficiency in the cow herd, a producer must take a critical look at the whole operation to make decisions, which go beyond the management of the cow and cow herd.

Conclusions

In order to achieve biological and economic efficiency in the cow herd, producer must individually evaluate how to match their cows to their economical environment. Producers need to consider the biological type of their cow in regards to age at puberty, ability to rebreed, milk production, growth rate, mature size, feed efficiency, and body composition. And this needs to match to the characteristics of the production environment which include amount and cost of grazing forage; amount and cost of harvested feeds; ability to store and deliver feed efficiently, machinery and equipment costs; labor costs; and other overhead expenses. Since beef cow calf production is highly dependent on the environment and diverse set of resources available to a region, producers need to assess for themselves what management strategies will work best for their cow herd and this will only become more important as input costs rise and resources tighten.

References

Field, T. G. 2007. Beef Production and Management Decisions. 5th Edition. Pearson Education, Inc., Upper Saddle River, New Jersey.

Roberts, A., 2011. Range Beef Cow Symposium Proceedings. http://www.rangebeefcow.com/2011/summaries/AndyRobertsFeedEff.html

National Program for Genetic Improvement of Feed Efficiency in Beef Cattle

Our goal is to sustainably reduce feed resources required to produce beef via the rapid development and deployment of novel nutritional, genomic and genetic improvement technologies.

We will strengthen the international competitiveness of US agriculture and enable increased food production by increasing the animal protein produced without additional feed inputs and with a reduced greenhouse gas footprint.

What is the project?

✓ The project involves a consortium of scientists, industry partners, breed associations, and cattle producers who will collect DNA samples and feed intake, growth and carcass composition data from over 8,000 animals (8 breeds).

✓ Over 2,400 animals will be genotyped to generate across-breed molecular expected progeny differences (**MEPDs**) for feed efficiency, feed intake, growth and carcass traits.

✓ In addition to creating and validating selection tools for producers, we will also be examining the DNA of efficient animals and seeking straightforward methods to identify efficient animals without measurement of individual intakes.

✓ This project involves developing tools for marker assisted selection (MAS) and also for marker assisted management (**MAM**). MAM is application of specific management practices (e.g. diet, days on feed, etc.) based on an animal's genotype so that it reaches a given outcome group (i.e. choice) with the least feed inputs.

Why is this important?

A 1% improvement in feed efficiency has the same economic impact as a 3% increase in rate of gain.

The traits that beef producers routinely record are outputs which determine the value of product sold and not the inputs defining the cost of beef production. The inability to routinely measure feed intake and feed efficiency on large numbers of cattle has precluded the efficient application of selection despite moderate heritabilities (h^2 = 0.08-0.46). Feed accounts for approximately 65% of total beef production costs and 60% of the total cost of calf and yearling finishing systems. The cow-calf segment consumes about 70% of the calories; 30% are used by growing and finishing systems.

Table 1 shows the potential cost savings to the US beef cattle industry that could occur with selection for feed intake, feed efficiency, growth, and carcass traits. Calves and yearlings selected for residual feed intake (RFI) have the same ADG but eat less feed thus saving feedlot operators money. Assuming 27 million cattle are fed per year and that 34% of cattle in the feedlot are calves and 66% are yearlings, the beef industry could save over a billion dollars annually by reducing daily feed intake by just 2 lb. per animal.

University of Missouri
Dr. Jerry Taylor, Project Director
Dr. Monty Kerley
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Dr. Stephanie Hansen
Dr. Dan Loy
Dr. J R Tait

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Dr. Robert Weaber

Texas A&M University
Dr. Chris Seabury

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Dr. Jon Beever
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Dr. Dan Shike

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Dr. Matt Spangler

USDA-BELTSVILLE
Dr. Tad Sonstegard

USDA-MARC
Dr. Harvey Freetly
Dr. John Pollak

Washington State University
Dr. Kris Johnson
Dr. Holly Neibergs

Table 1. Estimated cost savings to the US beef cattle industry from selection for a 2 lb reduction in residual feed intake.

In Wt.	Out Wt.	Lb. Gain	ADG	Days on Feed	RFI	Reduced Feed Intake (lb)	Feed Cost Savings $/hd	% of Fed Mix	Total Feed Cost Savings
					Calf Feds				
600	1250	650	3.5	186	0.0	0			
600	1250	650	3.5	186	-2.0	-372	(54.72)	34	$ 502,620,656
					Yearling Feds				
775	1300	525	4.0	131	0.0	0			
775	1300	525	4.0	131	-2.0	-262	(38.67)	66	$ 689,539,820
								Total Savings:	**$ 1,192,160,476**
Annual fed slaughter cattle: 27 million head; Delivered feed cost: $ 294.62 as fed									

Weaber, 2011

How will this benefit me?

You will have genetic selection tools and techniques (**MEPDs**) that will allow you to create a cow herd that is more efficient at converting nutrients to calf gain. Additionally, the steers and heifers you send to a feedlot will use less feed to produce the same amount of high quality protein for human consumption.

Will this really work?

✓ MEPDs have been successfully employed for output traits (i.e. growth and carcass) on a within-breed basis in beef cattle. Results from the dairy industry have shown tremendous advantages, particularly in evaluating young sires, through the use of MEPDs.

✓ A large demonstration project that aims to illustrate the efficacy of tools developed from this project includes a group of approximately 20 seedstock producers from seven states representing the seven major U.S. beef breeds along with a large commercial ranch. Producer owned sires will be used to generate crossbred progeny that will have growth, feed intake and carcass data collected. These steer progeny and their sires will be genotyped.

✓ The demonstration component enables a validation of discovery work from the project and a visible demonstration utilizing academic and industry resources working towards a common goal, the development and employment of genomic tools to improve feed efficiency.

✓ Producer collaborators will provide DNA samples on females within their herds to examine the relationship between female fertility/longevity and feed efficiency. Inclusion of fertility/longevity traits in the project enables selection decisions to be made with a more complete understanding of potential genetic antagonisms across a suite of economically important beef production traits.

How can I keep up to date?

✓ Go to: www.beefefficiency.org
✓ Watch for episodes on NCBA's Cattlemen to Cattlemen television show.
✓ Attend meetings or presentations by members of the research team.

Producer Resources

Website
www.beefefficiency.org

Broadcast Media
NCBA's Cattlemen to Cattlemen

Multimedia Presentations
Webinars

2-day Conferences
Research updates
Feed efficiency component traits
Strategies for genomic selection
Commercial herd sire selection
Feedlot marker-assisted management (MAM)

Youth Leadership Conferences

Educational materials
Powerpoint™ presentations
eXtension materials

Software
Decision support software for sire selection and evaluation of economics of implementing MAM

Field demonstration projects

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USDA United States Department of Agriculture National Institute of Food and Agriculture

Alternative Feedstuffs and Changing Coproducts for Cowherd

Dan W. Shike, Ph.D., University of Illinois at Urbana-Champaign

Introduction

The combination of decreasing acres available for crop production, an increasing world population, increased utilization of grain for fuel and increased input costs (fuel, transportation, and fertilizer) have resulted in limited feed supplies and higher feed costs. Additionally, the recent drought in much of the United States has further reduced the available feed supply driving feed costs dramatically higher. Historically, feed costs have represented 50-70% of the cost of production for beef enterprises. This past year, the high prices for corn and hay have driven that percentage over 80% for many operations. Cow-calf producers have been forced to investigate alternative feedstuffs to lower the cost of production. Ideally, the cowherd is grazing a significant portion of the year. Grazing days varies drastically throughout different regions of the United States and is greatly impacted by year to year differences in weather patterns. Drought limits summer grazing. Snow and ice can limit winter grazing. Harvested and stored feeds represent the majority of feed costs for cow-calf producers. With hay supplies low and hay costs high, producers need to consider alternative feeds for winter feeding and for emergency drought relief.

Alternative Feedstuff Considerations

Fortunately, beef cow-calf producers have options. Many alternative feeds can meet the needs of beef cows. Producers need to consider: nutrient composition, availability and consistency, storage and feeding, effects on performance, and cost. Available feedstuffs will vary from region to region, but many will meet the needs of the cowherd if all criteria are properly considered.

Nutrient Composition

It is critical to match the feed resources to the needs of the cows. Unfortunately, many producers don't know the information necessary to do this. It is critical to have feeds analyzed. If you do not know the nutrient composition of a feedstuff, is impossible to know if you are adequately meeting the needs of your cowherd. The second part of the equation is knowing the needs of your cowherd. How much do your cows weigh? What is the breed composition? What stage of production are they in? A 1600 lb Simmental cow nursing a 2-month old calf will have a much different requirement than a 1100 lb Hereford cow that is in mid-gestation and is not nursing a calf. Some alternative feedstuffs have different supplement considerations. If you are feeding high levels of corn coproducts, you will want to make sure you have adequate calcium in your mineral supplement to balance the calcium : phosphorous ratio.

Availability and Consistency

It is important to know the availability of the feedstuff you are considering. Is there a steady supply or is it seasonal? Depending on your herd size, you may not be able to get adequate supply of a feedstuff. Some producers are equipped and willing to adapt and change to fluctuations in supplies of products. Other producers do not want to hassle with the uncertainty. Producers also need to consider the consistency of the product. Many of the coproducts vary in composition from plant to plant. A nutrient analysis on a product in Illinois may not do you much good if you are getting the product from a plant in Nebraska. Ethanol plants have worked hard to improve the consistency of their products, but variation still occurs from plant to plant and even within plant. This is another reason why it is essential to analyze the feedstuffs you have on inventory.

Storage Considerations

Storage and handling of the products must be considered. Most producers are set up to store hay and grain. If the alternative feedstuffs require storage and handling equipment beyond the needs for hay and grain, then there will be additional costs. Herd size often is an important factor when considering alternative storage and handling equipment. Larger herds can more easily afford equipment and can more quickly utilize wet or perishable feedstuffs. Smaller herds will be more limited on feedstuffs that can be utilized.

Performance of Cattle

For many producers, the true test of an alternative feedstuff is the evaluation of the performance of the cattle. If cattle fed alternative feedstuffs perform similarly to cattle that are fed traditional feedstuffs, producers become confident in the product. Many studies have been conducted evaluating the use of alternative feedstuffs in both gestating and lactating cow diets. When nutrient requirements of the cows are met, many combinations of alternative feedstuffs have proven to be effective. Studies have evaluated effects on cow body weight and body condition score, calf birth weight, milk production, weaning weight, reproduction, and even subsequent calf growth and carcass traits. Feedstuffs vary from region, but if nutrient requirements are met cow performance is not compromised.

Cost

When all other criteria have been considered, the real deciding factor is cost. However, it is not always that easy to compare costs. It is important that you are comparing “apples to apples”. The dry matter of alternative feedstuffs will vary greatly and thus it is important to compare costs on a dry matter basis. Don’t forget to consider additional costs associated with trucking, storing, and feeding the various products. Beef cow-calf producers that identify low-cost alternative feedstuffs will greatly improve profitability.

Changing Coproducts

The ethanol industry is continually changing; thus, the resulting coproducts are continually changing. Currently, the trend appears to be to pull additional fat out of distillers grains. Although this will result in a lower energy product, this should not greatly impact distillers grains use in the cowherd. As the refining process changes and coproducts evolve, producers will need to continually evaluate the nutrient analysis of the coproducts and modify feeding strategies / supplements as necessary.

Summary

Limited feed supplies and high feed costs have caused beef cow-calf producers to consider alternative feedstuffs. Feed costs represent at least 60% of the costs associated with beef production. Stored or purchased feed represents the majority of these feed costs. There are many alternative feedstuffs available, and they vary greatly from region to region. Producers must consider the nutrient composition of the feedstuff, availability and consistency of product, storage and feeding equipment, performance of cattle and ultimately the cost of the product. As the ethanol industry evolves, corn coproducts continue to change. Thus far, changes in coproducts have had minimal impacts on the cow-calf producer. Producers that identify opportunities to utilize low-cost alternative feedstuffs and coproducts will likely be the most profitable.

Alternative Feedstuffs and Changing Co-products:

Feedlot Cattle

Tara L. Felix, Ph.D., University of Illinois at Urbana-Champaign

For the past decade, the amount of ethanol fuel produced from corn each year has increased dramatically. This increase in ethanol production increases the demand for corn to be used as fuel and decreases its supply for livestock feed. The increasing ethanol production also increases the supply of corn co-products, feeds produced in the conversion of corn to ethanol. Traditionally co-products have been included in beef feedlot rations to decrease costs. The increasing supply of co-products and decreasing supply of corn due to ethanol production have made co-products an economically attractive energy source for cattle producers leading to their higher inclusion in diets.

For example, distillers grains with solubles (DGS) have been an important, low cost protein source for feedlot producers for over 3 decades. In the last 5 years, demand for DGS has increased as the cost of corn has made them an economically attractive source of energy. Using DGS as an energy source has presented 3 major challenges. **#1 Protein**: The "traditional" DGS diet may have contained approximately 25% DGS on a dry matter basis (DMB) and supplied approximately 14.3% CP (DMB) to the diet. Last year, however, it was not uncommon to see feedlot diets that included 50% DGS, increasing dietary protein to roughly 19% (DMB). The shift to use DGS as an energy source has some researchers questioning the long term ramifications of feeding so much excess protein, not only on the environment, but also on the animal**. #2 Fat**: Another challenge with using DGS as an energy source has been the fat content. Feeding fat in excess reduces fiber digestibility and cattle performance. Some DGS may contain as much as 10 to 12% fat (DMB). Fiber content in feedlot diets is often low and high fat DGS have not proven to be as big of a concern as once thought. In fact, it is now believed that the fat in DGS works well to supply energy to feedlot cattle and may be the reason that DGS has 10 to 20% more energy than corn when fed at 40% of the diet (DMB). However, fat represents another avenue of income for ethanol companies and this past year, many plants began de-oiling their co-products. Reduced fat will mean reduced feed energy for cattle producers who used DGS as an energy source. **#3 Sulfur**: The 3rd major issue with feeding DGS as an energy source has been sulfur content. Unfortunately, due to the use of sulfuric acid in the production of ethanol, this one may not be an easy fix. Some new investigations have looked at using phosphoric acid in place of sulfuric, but the efficiency of ethanol production using this technique has not been good enough for it to become an industry standard. That said, most plants will have a sulfur value on their DGS, but that value may vary within plants and between plants. The typical range of sulfur in DGS can be anywhere from 0.35 to 1.00% (DMB). The moral of this story is to test your DGS and/or ask for the plants analysis of their DGS. Two important considerations with DGS are cost and availability. The cost of DGS follows the cost of corn. As corn price increases, price of DGS increases. In August of 2012, the drought in the Midwest had driven the cost of corn so high, that several ethanol plants were no longer running. Availability of DGS became a serious issue.

Another co-product gaining popularity in the industry is corn stover. Over the past few years, there has been a tremendous effort to increase the use of corn stover for feedlot cattle by increasing its feeding value. The most popular technique to do this has been treating corn stover with 5% calcium oxide (CaO). This treatment process does require some equipment and labor, despite this, it is gaining popularity. This process involves grinding the corn stover, wetting it to 50% dry matter, and then adding 5% CaO (DMB). The "treated" corn stover must sit for at least 1 week before feeding to allow the chemical reaction to be effective. An emerging term, corn replacement feed, uses 20% treated corn stover and 40% wet DGS to "replace" 60% of the corn in a traditional feedlot diet. Results have been somewhat variable.

Because of the 2012 drought in the Midwest, many producers in the region harvested corn silage instead of corn. Corn silage can be an excellent feed, especially for growing cattle. Cattle can be fed ad libitum silage with supplemental protein and minerals. Calves that are 600 to 700 lbs can eat enough silage to gain about 3 lbs per day if they are fed for ad libitum intakes. When cattle reach 800 lbs, more of the energy in silage will be used for their increased maintenance needs so gains will likely drop to 2 or 2.5 lbs when fed for ad libitum intakes.

Although diets high in co-product inclusion have become normal for cattle feeders, this year high inclusions of silage may be the best ration option. If you have corn silage, it will be cheaper to have cattle at 2 to 2.5 lbs gain per day with corn silage than to buy corn and co-products in this market. In this feed environment, the bottom line is options. Cattle can be adapted to a number of different diets. In this environment our feedlot cattle rations should be based on cost of gain and availability of feeds.

REPLACEMENT FEMALE STRATEGIES

G. Allen Bridges, University of Minnesota

Introduction

Most beef operations are reliant on the generation of replacement heifers. Replacement heifers are intended to replace old or non-productive cows, incorporate new and hopefully improved genetics into the herd, and be productive females as young cows and then subsequently deliver several more generations of calves. Thus, there are both short-term and long-term objectives when selecting and developing replacement beef heifers. As such, implementing proper selection criteria, growth and developmental strategies, health and nutritional management, and breeding programs for replacement beef heifers are essential to meet both short-term and long-term objectives of the operation. From a short-term standpoint, retaining and developing a replacement heifer represents a considerable investment. Failing to properly develop a young female may limit her ability to reach puberty, conceive, and calf. In addition, improper development can impede her ability to stay in the herd for more than a few years and impact her progenies performance. From a long-term perspective, the future genetic make-up of the cowherd is contingent on the decisions made when selecting and developing the replacement heifers. Thus, the genetic composition and production traits of the beef herd for the next seven to ten years is derived from heifer selection done today. This article focuses on targeted breeding systems to yield potential replacements, selection of replacements, and management practices and nutritional delivery for developing replacement beef heifers.

Breed and Sire Selection

To be the most effective, heifer selection decisions should be made prior to the birth of the eventual replacement heifers. This involves selecting the breed of the replacement heifer as well as the sire. Although most beef producers have established the breed(s) of cattle that they prefer and believe are the best suited for their environment, management, and marketing plans; careful considerations should be made on the ultimate genetic make-up of the eventual replacement heifers. Moreover, the intent of this article is not to argue over which cattle breeds are superior. Rather, recognize that progressive cattlemen should use foresight to select breeds and/or selected matings that have the potential to deliver genetically superior replacement heifers. Included in this foresight is the argument that most commercial cow/calf producers would benefit from using crossbred rather than purebred beef cows. As will be indicated in data presented below, the long-term impacts of implementing a crossbreeding program are substantial. For producers not currently utilizing crossbred cows, initiating a crossbreeding program into the herd through strategic cow matings to deliver crossbred replacement heifers is recommended.

Crossbreeding offers two distinct advantages, 1) heterosis (hybrid vigor), which is the superiority in performance of the crossbred animal compared to the average of the purebred parents, and 2) using complementary breeds and combining strengths of the various breeds that make up the cross. As it relates to replacement heifers, crossbreeding may offer specific advantages to the heifer and her ability to reach puberty and her lifetime productivity in the cowherd. An approach to reduce the age of puberty of replacement heifers is crossbreeding with another breed that has a similar or younger age at puberty. Therefore, utilizing hybrid vigor results in a replacement heifer that is anticipated to reach puberty at a younger age and lesser body weight than the average of her parents. Perhaps a greater advantage of crossbreeding is realized in the mature cowherd. Studies conducted at Purdue University (Stewart and Martin, 1981) in Angus, Shorthorn, and Angus x Shorthorn crossbreds demonstrated that, due to hybrid vigor, during their lifetime the crossbred Angus x Shorthorn cows had 0.9 more calves, yielded 506 more pounds of weaning weight, and averaged approximately 64 more pounds of calf at weaning each year than the purebred cows. Similar lifetime productivity advantages of crossbred cows over purebred cows have been demonstrated by researchers at the USDA Experiment Station in Clay Center, NE (Table 1; Cundiff and Gregory, 1999). Thus, by utilizing an appropriate crossbreeding system, beef producers can reduce the age at puberty of their replacement heifers and subsequently expect greater lifetime performance of these crossbred females when they enter the cowherd.

Table 1. Advantage of the Crossbred Cow[1]

Trait	Observed Improvement	% Heterosis
Calving rate, %	3.5	3.7
Survival to weaning, %	0.8	1.5
Birth weight, lb.	1.6	1.8
Weaning weight, lb.	18.0	3.9
Longevity, yr.	1.36	16.2
Cow Lifetime Production:		
Number of calves	.97	17.0
Cumulative weaning wt., lb.	600	25.3

[1]Adapted from Cundiff and Gregory, 1999 & S. P. Greiner, Virginia Tech Cooperative Extension Publication 400-803

The greatest advancement in genetic improvements in a beef herd begins with sire selection for generating replacement females. The replacement heifers in a beef operation should represent the best and most advanced genetics in the cowherd. Without this approach, little genetic improvement is made. With such an impact that sire selection can have on a beef operation, it is important that producers are utilizing the best available tools for selecting sires to generate replacement heifers. The tool most readily available to assist with genetic evaluation is Expected Progeny Differences (EPDs), which are designed to assist the producer in predicting the performance of the future offspring.

When using EPDs to assist with sire selection it is advisable to follow these recommendations: 1) Traits of economic importance should be prioritized and based on management practices and marketing plans of the specific herd; 2) The traits selected and level of the traits should be matched to the nutritional resources available and the environment. For example, selecting a sire with high milk EPD may not be a prudent choice if the nutritional resources are not available for that heifer to achieve this level of milk production; 3) Strive towards optimization rather than maximization. In other words, don't select a sire base only on him excelling in one trait (i.e. birth weight) but rather select a better-rounded sire that has above average numbers for multiple traits of importance. A few EPDs to pay close attention to when selecting a sire to generate replacement heifers include maternal traits such as Milk, Birth Weight, Calving Ease, and Calving Ease Maternal as well as Docility and Scrotal Circumference.

Birth to Weaning Management

Once breeding is accomplished the next managerial step in replacement heifer development is the period from birth to weaning. Although this period is often overlooked when developing beef heifers, poor management during this period of development can have dire consequences. The first step in management at this stage has nothing to do with the heifer calf itself, but rather her mother. Try to ensure that cows delivering the potential replacement female heifer calves are in adequate body condition score (BCS; 1 = emaciated, 9 = obese) at the time of calving. Cows should be between a 5 and 6 BCS at calving. Failing to have cows at least a 5 BCS will result in reduced colostrum production and reduced colostrum quality. Without adequate colostrum to provide the required antibodies and immunity to disease, the newborn heifer is already off to a poor start. In addition, cows in adequate BCS also produce more milk than thin cows, thus increase growth rate of their calves.

At birth, calves should be identified through ear tagging and dam, birth date and birth weight recorded for future reference. Not knowing dam, sire, birth date, and birth weight limits the ability to make managerial decisions. Also having this information allows for more appropriate heifer selection criteria to be used and more efficient identification of unproductive older cows for culling. At calving replacement heifers should not be administered a growth promoting implant. Furthermore, although some growth promoting implants are approved for use in older replacement heifers, due to the potential risk of lessened fertility, it is a general recommendation to not implant potential replacement heifers at any age. In addition, producers should work with their local veterinarians to develop a herd vaccination program specific to their location and diseases prevalent.

Pre-weaning growth rate is important to sexual maturation and attainment of puberty in beef heifers. It has been demonstrated that pre-weaning average daily gain (ADG) has a more consistent impact on age at puberty in beef heifers than post-weaning ADG (Wiltbank et al., 1966) and that heifers with greater pre-weaning body weights tend to reach puberty at an earlier age (Arije and Wiltbank, 1971). Additionally, Buskirk et al. (1995) reported the probability of beef heifers reaching puberty is positively influenced by weaning weight in addition to post-weaning gains. Other research has also demonstrated that strategies that indirectly increased early growth performance (prior to 7 mo of age) reduced age at puberty in heifers (Mejia et al., 1999; Lacau-Mengido et al., 2000; Madgwick et al., 2005). Without question pre-weaning growth impacts subsequent sexual development, however the constraint is how to effectively manage this at the farm. The best managerial strategy is to ensure the cows nursing the potential replacement heifers are adequately fed, thus allowing them to produce adequate milk for calf growth. Another potential strategy is creep feeding. Creep feeding has an inherit risk however, in that providing excess nutrition during early life may impair mammary gland development through promotion of fat deposition and negatively impact milk production as a mature cow (Hixon et al., 1982). This is most evident in early maturing British breeds. For later maturing and larger-framed Continental breeds, creep feeding may not as drastically impact maternal performance (Friedrich et al., 1975). Thus breed composition and aggressiveness of creep feeding program must be considered before implementing such a program.

Heifer Selection at Weaning

At weaning several criteria exist for selecting those heifers that should be specifically developed and kept as replacement females. In general it is advisable to keep 10 to 25% more heifers than ultimately needed. This allows subsequent culling of heifers that fail to perform during later stages of development, accounts for potential death loss, and unfortunately not all heifers developed will conceive and become pregnant. Avoid freemartins, or a heifer calf that was a twin to a bull calf. Greater than 90% of the time, the female in a male-female twin scenario will be infertile. Also, cull heifers that are not structurally sound, do not appear to have strong maternal characteristics, had extreme birth weights, those that were born to unproductive cows, and those that have a history of health issues.

The key is to select heifers that have the greatest probability to reach puberty on time, conceive, produce calves that perform, and are able to remain in the cowherd for numerous years. In general, select heifer calves that have the greatest actual weaning weights and are the oldest at weaning. Using actual weaning weight rather than 205-adjusted weaning weight provides a more accurate reflection of weight gain needed prior to breeding. Selecting the heifers that are oldest at weaning means she will be older at breeding, which is critical as age at puberty is determined by age and weight. Also, being born early in the calving season potential provides some indication of her potential fertility as her dam conceived early in the breeding season. Although selecting the heaviest and oldest at weaning may be a ‘general recommendation’, individual animal characteristics as well as desired future herd composition must also be considered. At times, the heaviest heifers at weaning may be overly fat and/or exhibit “bullish” characteristics, both traits that are not desirable in replacement heifers. In addition, if a producer wants to reduce mature cow size, selecting the heaviest and/or largest framed heifers at weaning may not be the prudent choice. In such instances, producer may consider selecting heifers that fall within a previously established 205-day weaning weight ratio, thereby not selecting the heaviest but heifers that still had greater weaning weights than the herd average.

Weaning to Breeding Management

Once heifers are selected at weaning, the most intensive management portion of heifer development begins. A goal of heifer development is to nutritionally manage heifers in a manner that allows them to reach puberty by 12 to 13 months of age, thereby allowing them to conceive by 15 months of age and calve at 24 months of age. It has been demonstrated that heifers that have more estrous cycles prior to the start of the breeding season have a greater opportunity to conceive early in the breeding season (Byerley et al., 1987). Developing heifers so that they conceive early in the breeding season and subsequently calve early in the calving season is critical for heifer longevity in the herd as well as the performance of her progeny in subsequent generations. A recent report by Kill et al. (2012) demonstrates the importance of early conception in beef heifers. This study evaluated the longevity data of over 2,100 heifers on South Dakota ranches and longevity and weaning weight data on 16,549 individual heifers (data gathered for 20 years) at the U.S. Meat Animal Research Center (USMARC). In both scenarios, heifers were classified as calving in either the first 21 days (day 1 to 21) of the calving season, second 21 days (day 22 to 42) of the calving season, or greater than 42 days after the start of the calving season. The results clearly demonstrated from both South Dakota and USMARC (Figure 1; Kill et al., 2012) that heifers that calve later at their first calving fail to remain in the herd as long as heifers that calve earlier at their first calving.

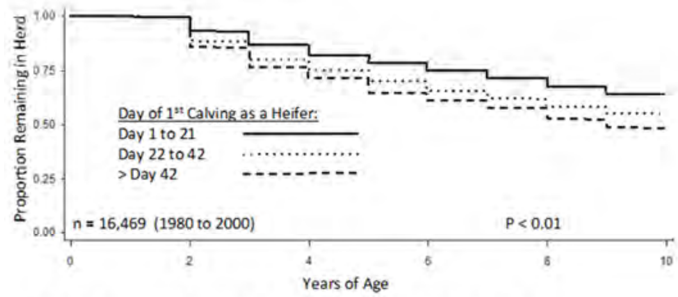

Figure 1. Relationship between day of calving as heifer in the first calving seasonand longevity in the herd

Similarly, when weaning weights of calves were evaluated at USMARC, weaning weights of calves from cows calving later at their first calving were less ($P < 0.05$) compared to heifers calving earlier at their first calving and this significant difference in weight was observed for their first 5 calves (Figure 2; Kill et al., 2012). The reason for these observations can be explained. If a heifer conceives late and subsequently calves late, she has less time from calving until the start of the subsequent breeding season, she is more likely to be anestrus, or not having estrous cycles, at the start of breeding, will likely then conceive late again in the second breeding season, and the cycle continues to repeat until eventually she fails to conceive in a confined breeding period and is culled from the herd. Likewise, her calve will continually be the youngest calves at weaning and hence the lightest given that age at weaning has the greatest influence on weaning weight.

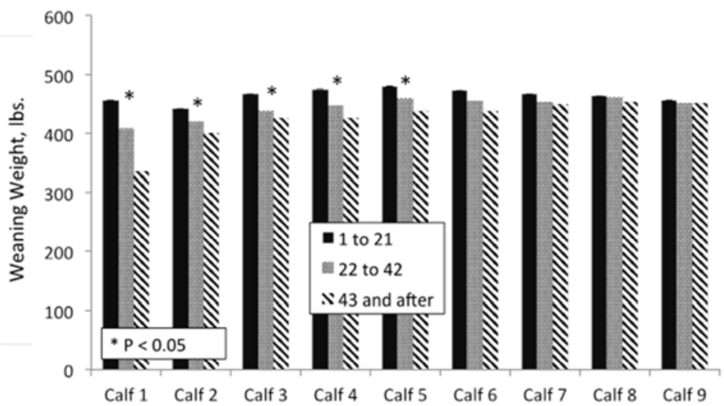

Figure 2. Relationship between day of calving as heifer in the first calving season and weaning weight of subsequent calves

To ensure the heifers conceive early in the breeding season, heifers must reach puberty prior to the beginning of the breeding season. Attainment of puberty is a function of both age and weight with the underling influence of genetics (breed variations). Although breeds of cattle vary in their approximate age at puberty, most *Bos taurus* breeds used in the mid-west are capable of reaching puberty by 15 months of age given that proper nutrition is provided. This is another advantage of crossbred females, as their age at puberty is less than the average of the purebreds that make up the cross. Age plays a critical role in puberty attainment, hence the desire to select heifers that are older than the herd average at weaning. Nutrition and growth performance is the aspect of puberty most influenced by post-weaning management. The question is: how much must a heifer weigh at breeding to ensure she has attained puberty? The general rule for heifer development is that at breeding, heifers should weigh approximately 65% of their estimated mature cow weight. As such, if a producer has moderate-framed cows with an average cow weight of 1250 lbs., at breeding heifers should weigh 813 lbs. If the cows are larger-framed and mature cow weight averages 1400 lbs, heifers should weigh 910 lbs. at breeding.

The growth curve by which the heifers reach their target weight at breeding does not impact their ability to attain puberty as long as the target weight is achieved (Figure 3; Clanton et al., 1983; Lynch et al., 1997; Freetly et al., 2001). Slow growth followed by a period of rapid growth and compensatory gain is an effective method of heifer development and has been demonstrated to be the most cost-effective method. However, such an approach does have a risk. If an unexpected event occurs during the rapid growth period (examples include a late spring snow storm or disease outbreak) that limits feed intake or growth rate, the target weight may not be achieved, thus negatively impacting heifer performance. Likewise, rapidly growing the heifers and then slowing growth rate and "holding them back" is also acceptable. However, with this strategy producers run the risk of over-finishing the heifers and having them overly fat at breeding. Excessive fat deposition is unwanted and has the potential to negatively impact reproductive performance. A linear growth rate may be the easiest to accomplish. By knowing weaning weights, date of initiation of the anticipated breeding season, and target weights required, the average daily gain required by the heifers to reach their target can be derived. For example, if average weaning weight was 550 lb. on October 10, the breeding season is anticipated to begin on May 15 (218 days), and the target weight to reach 65% of estimated mature body weight was 813 lb. (equation: (813-550)/218); heifer would have to gain 1.2 lbs. per day. With this information and diet can be designed to achieve this weight gain.

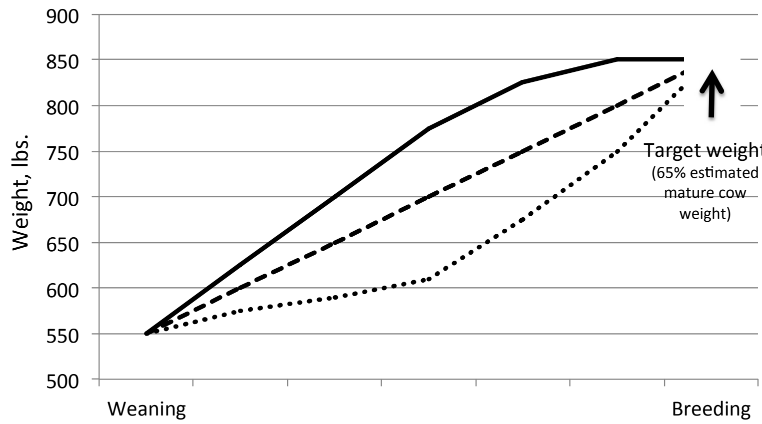

Figure 3. Examples of potential growth curves of replacement heifers from weaning until breeding.

Regardless of the strategy chosen for growth rate in heifers from weaning to breeding an additional problem exists: not all heifers will have the same weaning weights. The question then become, what weaning weight do I use to figure the required gains to reach the target weight? If you use the average weight at weaning to calculate the required average daily gain, half of the heifers will be over the target weight and overly condition, while the other half will fail to meet the target. To avoid this dilemma, it is advisable, when possible, to split heifers into multiple groups. By splitting heifers in to a heavy and light group (or more groups if capable), producers can specifically design diets and deliver feed for each group independently, and reaching the target weight for each heifer will be easier to achieve.

Breeding and Post-Breeding Management

It is advisable to begin the breeding season for replacement heifers two or three weeks prior to the start of the breeding season of the mature cows. This allows more time after calving for the first-calf heifers to reinitiate having estrous cycles thus increasing their likelihood of getting pregnant in the subsequent breeding season. At calving, heifers should be approximately 85% of their estimated mature body weight and in a body condition score of 5.5 to 6. Be cautious not to have them overly fat as this can increase the incidence of calving difficulties.

A complete other article could be written on reproductive management of heifers at breeding that discusses the advantages of estrous synchronization and artificial insemination (AI). In brief, both reproductive management technologies offer numerous advantages. Estrous synchronization allows producers to get more heifers bred in the earlier part of the breeding season, which as discussed above has numerous benefits. In addition, many of the estrous synchronization protocols available include a progestin, a hormone that will stimulate pre-pubertal heifers to attain puberty. Thus, further assisting more heifers to get pregnant sooner in the breeding season. Using AI allows producers to select genetically superior bulls that are proven to have low birth weights and calving ease, traits important in bulls used to breed heifers. In addition, there are several AI sires that provide exceptional calving ease genetics but still retain tremendous growth potential in their progeny.

At the start of the breeding season, producer must be cognizant of sudden nutritional changes that the heifers may be experiencing. In many instances, heifers are developed in a dry-lot environment. Once breeding season arrives, often heifers are immediately sent to pasture either following AI or just let out with herd bulls. This creates two potential problems. First, the nutritional difference in the dry-lot diet and the forage available may be considerably. Second, heifers that have been in the dry-lot are not accustom to eating grass. Both scenarios often cause a period of weight loss and or change in nutritional metabolites that can negatively impact reproductive performance (Perry et al., 2009; S. Lake, University of Wyoming & R. Lemenager, Purdue University, Unpublished). Therefore, if developing heifers in a dry-lot scenario, try to avoid over-feeding concentrates and rather use a forage-based diet. If a high-concentrate diet is used during heifer development, once heifers are moved to pasture continue moderate supplementation until heifers adapt to the pasture diet.

Take Home Message

Heifer selection and development is critical for the future productivity of beef operations. Moreover, it is an expensive aspect of beef production and thus should be critically managed. Heifer development should not begin at weaning of the heifers or even at birth of the potential replacement but rather the breeding season before when sires are selected. For commercial cattlemen there are definite advantages to developing breeding systems to deliver crossbred females. Once the heifer calf is born, the actual management of that specific female begins. Every aspect of her development, including pre-weaning management, post-weaning growth and development, breeding, and post-breeding management can impact her ability to conceive, maintain a pregnancy, deliver a live calf, and her longevity in the herd. The importance of heifers reaching puberty prior to the start of the breeding season thus increasing their probability of conceiving early in the breeding season cannot be overly stressed. Failing to meet the target weights and failing to properly manage the heifer so she can conceive in the first 21 days of the breeding season drastically impedes her longevity in the herd and the performance of her subsequent progeny for generations to come. Proper heifer development is therefore setting the stage for the future productivity of the cowherd.

References

Arije, G.F. and J.N. Wiltbank. 1971. Age and weight at puberty in Hereford heifers. J. Anim. Sci. 33:401-406.

Buskirk, D.D., D.B. Faulkner, and F.A. Ireland. 1995. Increased postweaning gain of beef heifers enhances fertility and milk production. J. Anim. Sci. 73:937-946.

Byerley, D.J. R.B. Staigmiller, J.G. Berardinelli, and R.E. Short. 1987. Pregnancy rates of beef heifers bred either on puberal or third estrus. J. Anim. Sci. 65:645.

Clanton, D.C., L.E. Jones, and M.E. England. 1983. Effect of rate and time of gain after weaning on the development of replacement beef heifers. J. Anim. Sci. 56:280-285.

Cundiff, L.V. and K.E. Gregory. 1999. What is systematic crossbreeding? Proc. NCBA Cattleman's College, Charlotte, NC, February 1999.

Freetly, H.C., C.L. Ferrell, and T.G. Jenkins. 2001. Production performance of beef cows raised on three different nutritional controlled heifer development programs. J. Anim. Sci. 79:819-826.

Friedrich, R.L. et al., 1975. Creep feeding and subsequent maternal ability of Simmental cross calves. Proc. West. Section ASAS. 26:14.

Hixon, D.L., G.C. Fahey Jr., D.J. Kesler, and A.L. Neumann. 1982. Effects of creep feeding and monensin on reproductive performance and lactation of beef heifers. J. Anim. Sci. 55:467-474.

Kill, L.K., E.M. Mousel, R.A. Cushman, and G.A. Perry. 2012. Effect of heifer calving date on longevity and lifetime productivity. To be presented at the 2012 Midwest Sectional Meeting of the American Society of Animal Science, Des Moines, IA.

Lacau-Mengido, I.M., M.E. Mejia, G.S. Diaz-Torga, A. Gonzalez Iglesias, N. Formia, C. Libertun, and D. Becu-Villalobos. 2000. Endocrine studies in ivermectin-treated heifers from birth to puberty. J. Anim. Sci. 78:817-824.

Lynch, J.M., G.C. Lamb, B.L. Miller, R.T. Brandt, Jr., R.C. Cochran, and J.E. Minton. 1997. Influence of timing of gain on growth and reproductive performance of beef replacement heifers. J. Anim. Sci. 75:1715-1722.

Madgwick, S., A.C.O. Evans, and A.P. Beard. 2005. Treating heifers with GnRH from 4 to 8 weeks of age advanced growth and the age at puberty. Theriogenology 63:2323-2333.

Mejia, M., A. Gonzalez-Iglesias, G.S. Diaz-Torga, P. Villanfane, N. Formia, C. Libertun, D. Becu-Villalobos, and I.M. Lucau-Mengido. 1999. Effects of continuous ivermectin treatment from birth to puberty on growth and reproduction in dairy heifers. J. Anim. Sci. 77:1329-1334.

Perry, G.A., J. Walker, C. Wright, and K. Olson. 2009. Impact of method of heifer development and post-AI management on reproductive efficiency. *Range*

Beef Cow Symposium. Paper 263.

Scott P. Greiner. Beef Cattle Breeds and Biological Types. Virginia Cooperative Extension, Publication 400-803. http://pubs.ext.vt.edu/400/400-803/400-803_pdf.pdf

Stewart, T.S. and T.G. Martin. 1981. Mature weight, maturation rate, maternal performance and their interrelationships in purebred and crossbred cows of Angus and milking shorthorn parentage. J. Anim. Sci. 52:51-56.

Wiltbank, J.N., K.E. Gregory, L.A. Swiger, J.E.Ingalls, J.A. Rothlisberger, and R.M. Koch. 1966. Effects of heterosis on age and weight at puberty in beef heifers. J. Anim. Sci. 25:744.

Marketing Options for Holstein Steers

Jon Hansen, JBS USA, LLC

Introduction: Who is JBS and what do they offer me?

JBS USA, LLC the third largest beef processing firm in the United States, is a wholly owned subsidiary of JBS S.A. With its long tradition in producing Holstein beef and with three of its eight US beef plants specializing in Holstein beef processing JBS is the premier Holstein beef company. This now world leader in beef production had its roots in a humble family-owned business which began by processing a couple head of cattle per day in 1953. Today JBS S.A. is the world's largest animal protein processor with beef, pork and chicken processing facilities on five continents.

Holstein Steer Production:

The US produces about three million Holstein bull calves per year with the four state region of IA-IL-MN-WI accounting for 22% of that total. JBS processes just under one million Holstein steers per year – about 33% of the US total.

Holstein Marketing Options:

Livestock Auction Markets

Direct Country Shipments

Delivery Contracts (see attached samples)

SAMPLE ONLY

Contract Number: HYCO ______

YEARLING HOLSTEIN CATTLE DELIVERY CONTRACT

This agreement (together with any exhibits, the "Agreement") is dated as of _________, by and between JBS USA, LLC., a Delaware limited liability company (including its subsidiaries and affiliates, "JBS"), 1770 Promontory Circle, Greeley, CO 80634 and **[Seller Name],** ("Seller"), (Seller Address).

The parties have entered into this Agreement as of the date first written above. Signatures below show agreement of the parties for all details of the Agreement and Exhibit A shown above and to follow:

JBS:	SELLER:
______________________________	______________________________
Name:	Name:
Title:	Title:

PLEASE BE AWARE:
This Agreement will be priced automatically at the Pricing Deadline unless previously priced by you or Converted at your direction.

PREMISES

JBS confirms the purchase from Seller of Holstein steers (each, a "Holstein") in the quantities, and subject to the terms and conditions, provided in this Agreement.

AGREEMENT

NOW, THEREFORE, the parties agree as follows:

Units Contracted this Agreement:	
Each Unit contains 47,000 pounds which is an estimated 31-35 head	
Delivery Month:	
Delivery Location:	
Futures Price (per Cwt):	
Futures Basis (per Cwt):	
Five Area Basis (per Cwt):	
Contract Base Price (per Cwt):	

1. Purchase Price; Payment and Title.

(a) The sum of all Holsteins delivered pursuant to this Agreement with a total Delivered Weight from 45,600 lbs to 48,400 lbs, as delivered in fulfillment of each Unit, shall be purchased at the Contract Base Price. Delivered Weight in excess of 48,400 lbs, as delivered in fulfillment of each Unit, shall be purchased at the Current Cash Price. The purchase price of all Holsteins purchased pursuant to this Section shall be subject to the Adjustments set forth in Exhibit A hereto, which is incorporated by reference.

(b) Seller shall be responsible for communicating its pricing instructions to JBS, from the options provided by JBS, to enable JBS to determine the Futures Price for the Holsteins. If the Futures Price has not been determined on or before the Pricing Deadline, the Futures Price will be the settlement price of CME's Live Cattle Futures on such date, unless the Seller has Converted the Agreement prior to the Pricing Deadline. See 5.(c) for details of pricing in this situation.

(c) Seller shall be paid all amounts owed hereunder at the end of the business day immediately following the day the final grading results of all the Holsteins are available to JBS. JBS shall have the right to offset any amounts owing to Seller hereunder against liability arising from Seller's indemnification obligation in Section 4 and/or arising from any other agreement between JBS and Seller. No advance payments will be made hereunder.

(d) Title to each Holstein delivered hereunder shall pass immediately to JBS upon the last of the following: (i)JBS's final grading of the Holstein carcass; (ii)JBS's determination that that the Holstein was alive, healthy and in good and merchantable condition immediately prior to slaughter; and (iii)JBS's determination of all applicable Adjustments. JBS will not purchase Holsteins which are ill, injured, condemned or die prior to slaughter.

(e) All references to money in this Agreement are in US Dollars.

2. Inspection and Delivery of the Holsteins.

(a) Seller shall confer with JBS regarding the readiness of the Holsteins for delivery and will allow JBS (or its representative) to perform inspections of the Holsteins prior to their delivery. Any Holstein determined by JBS in its sole discretion to be unacceptable will not be purchased or delivered hereunder.

(b) Seller shall only deliver the Holsteins to JBS during the Delivery Month on a day designated by JBS. Holsteins may only be delivered outside the Delivery Month if agreed to in writing by JBS and then subject to Section 4(b).

(c) The Holsteins shall be weighed by JBS at or after arrival at the Delivery Location.

3. Seller's Representations and Warranties.

As an inducement to JBS to enter into this Agreement, Seller represents and warrants to JBS the following:

(a) Seller is a "merchant" as such term is defined in the Uniform Commercial Code (UCC) of the United States of America, with respect to the Holsteins, which are the subject of this Agreement.

(b) All Holsteins have been born and raised exclusively in the United States, shall be delivered in good and merchantable condition and are suitable for immediate slaughter to produce meat for human consumption.

(c) Seller has good and merchantable title to and has full power and authority to sell the Holsteins and the Holsteins are sold free and clear of all Liens. If JBS receives written notices of Liens on the Holsteins from Lienholders or learns of Liens by its search of the governing state's central filing system, Seller authorizes JBS to make settlement under this Agreement jointly with the Seller and the Lienholders or directly to the Lienholders.

4. Seller's Indemnification Obligations.

(a) General Indemnification Obligation: Seller agrees to indemnify and hold JBS harmless from and against any and all claims, causes of action, damages, losses, liability, proceedings, judgments, actions, costs and expenses (including attorney's fees and proceeding costs) arising from or relating to Seller's breach of any terms, representations or warranties of this Agreement.

(b) Delivery and Hedging Indemnification: Seller acknowledges and agrees that Seller's failure to deliver the Units of Holsteins in the Delivery Month and at the Delivery Location provided in this Agreement may result in substantial financial injury to JBS, including losses incurred by JBS in connection with JBS's hedging its price risk for the Holsteins purchased hereunder by the use of futures and options (each, a "Hedge") on the Chicago Mercantile Exchange. In the event that Seller fails to perform as provided in this Agreement, JBS may exercise all rights and remedies available to it in contract, law or otherwise, including, without limitation: (i) all reasonable expenses incurred in obtaining each replacement Holstein, including any additional cost of the replacement Holstein; (ii)any losses arising from lifting its Hedge; and (iii) all expenses incurred in connection with collecting from Seller any amounts owing hereunder including, without limitation, reasonable attorney's fees.

5. Definitions.

(a) "Adjustments" means premiums and discounts from the Contract Base Price, as outlined in this Agreement and Exhibit A.

(b) "Choice/Select Spread" means the difference in value of choice beef and select beef for the 600 to 900 weight category published in the USDA Boxed Beef Report for the week immediately preceding the slaughter date.

(c) "Contract Base Price" is an amount equal to the Futures Price plus the Futures Basis or, if the Agreement has been Converted by Seller, the Contract Base Price is an amount equal to the Five Area Price plus the Five Area Basis.

(d) "Converted" means the direction given by the Seller to JBS's contracting department to, once and for all, convert the unpriced Agreement so Holsteins will be priced at delivery based on the Five Area Price and Five Area Basis, instead of the Futures Price and Futures Basis. Converted Agreements may not be priced using a Futures Price.

(e) "Current Cash Price" means the cash price for like Holstein cattle available in the marketplace at the Delivery Location at the time of slaughter.

(f) "Cwt." means hundredweight.

(g) "Delivered Weight" means the weight of the Holsteins weighed by JBS at or after arrival at the Delivery Location.

(h) "Delivery Location" means JBS's processing facility in the city and state indicated in the chart at the beginning of this Agreement to which Seller, at its own expense, shall deliver the Holsteins.

(i) "Delivery Month" means the calendar month chosen by the Seller (as indicated in the chart at the beginning of this Agreement) in which the Holsteins will be delivered to JBS at the Delivery Location.

(j) "Five Area Basis" means the value established by JBS at the time the Agreement is executed which will represent the premium or discount to the Five Area Price (see 5.(c) for details on when this applies in pricing of Holsteins under this Agreement).

(k) "Five Area Price" means the stated Average Price of Live FOB Steers in Weekly Weighted Averages section of 5 Area Weekly Weighted Average Direct Slaughter Cattle report (LM_CT150) as published by USDA covering the week ending on the Sunday prior to slaughter. If there are less than 50,000 steers and heifers confirmed in this section of the report, the Five Area Price will be the Average Price from the prior week's report. If USDA discontinues this report, JBS will use the USDA published price it deems is most appropriate.

(l) "Futures Basis" means the value established by JBS at the time the Agreement is executed which represents the premium or discount to the Futures Price (see 5.(c) for details on when this applies in pricing of Holsteins under this Agreement).

(m) "Futures Price" means the price level of the Chicago Mercantile Exchange (CME) Live Cattle Futures Contract, at the time this Agreement is priced, for the CME trading month which corresponds to the Delivery Month as shown in the following table:

Delivery Month	Pricing Based on CME Trading Month
January and February	February
March and April	April
May and June	June
July and August	August
September and October	October
November and December	December

(n) "Hot Carcass" means a Holstein carcass immediately after slaughter at hot weight scale.

(o) "Hot Carcass Weight" means the weight of the Hot Carcass.

(p) "Lienholders" means holders of Liens.

(q) "Liens" means liens or encumbrances of any kind placed upon cattle as provided by law.

(r) "Prevailing Discount Rate" means the rate of discount normally applied by the Delivery Location at time of slaughter for similar adjustments.

(s) "Pricing Deadline" means the close of CME trading on the last trading day prior to the 15th day of the month preceding the Delivery Month.

(t) "Unit" means 47,000 lbs of Delivered Weight.

6. Force Majeure. Neither JBS nor Seller shall lose any rights hereunder or be liable to the other for damages or losses on account of failure of performance by a party (the "Defaulting Party") if such failure is occasioned by government action, war, fire, earthquake, explosion, flood, strike, lockout, embargo, or act of God beyond the control of the Defaulting Party; provided that the Defaulting Party claiming the force majeure has exerted all reasonable efforts to avoid or remedy such force majeure.

7. Confidentiality. JBS and Seller each hereby agree to keep confidential all of the terms and conditions of this Agreement, and to not divulge any of the terms hereof to any third party without first obtaining the express written consent of the other party unless otherwise required by law. Notwithstanding the foregoing, each party may disclose the terms and conditions of this Agreement to its key advisors, partners, agents and representatives of any corporate parent, investor, affiliate or subsidiary on a need to know basis.

8. Entire Agreement. This Agreement contains the entire agreement between the parties and shall be binding on the heirs, successors and assigns of the parties. Neither this Agreement, nor rights and obligations hereunder, may be assigned (by operation of law or otherwise) by Seller without JBS's prior written consent. SELLER AGREES TO SELL THE HOLSTEINS TO JBS IN ACCORDANCE WITH JBS'S REQUIREMENTS, SPECIFICATIONS AND PROCUREMENT POLICIES, AND JBS AGREES TO PURCHASE THE HOLSTEINS FROM SELLER IN ACCORDANCE WITH THE TERMS OF THIS AGREEMENT, THE TERMS AND CONDITIONS OF WHICH SHALL BE LEGALLY BINDING ON BOTH PARTIES. This Agreement must be signed and returned within ten (10) business days of receipt by Seller.

9. Waiver of Damages. JBS and Seller hereby voluntarily, knowingly, irrevocably and unconditionally (i) agree that damages shall be limited to actual and compensatory damages, and (ii) waive any right to claim or recover from the other party any special, exemplary, punitive, indirect or consequential damages, in the case of the foregoing (i) and (ii) for any claim (including contract, tort and all other claims) between or among JBS and Seller arising out of or in any way related to this Agreement, or other related document, or arising out of or in any way related to the transactions contemplated by this Agreement or other related document.

10. COUNTERPARTS. This Agreement may be executed in multiple counterparts each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument.

EXHIBIT A - ADJUSTMENT SCHEDULE

The following adjustments pertain to contract specifications on cattle delivered to JBS and shall adjust the proceeds due Seller.

Weight Adjustment
Hot Carcasses weighing from 750 lbs to 950 lbs have no Weight Adjustment

Other Hot Carcass Weight Ranges	Applicable Adjustment
• Each Hot Carcass below 700 lbs.	$25.00/Cwt. discount of Hot Carcass Weight
• Each Hot Carcass from 700 lbs. to less than 750 lbs.	$5.00/Cwt. discount of Hot Carcass Weight
• Each Hot Carcass from over 950 lbs. to 1,000 lbs.	$5.00/Cwt. discount of Hot Carcass Weight
• Each Hot Carcass from over 1,000 lbs. to 1,050 lbs	$10.00/Cwt. discount of Hot Carcass Weight
• Each Hot Carcass over 1,050 lbs.	$30.00/Cwt. discount of Hot Carcass Weight

Quality Grade Adjustment
Units with 80% choice and prime carcasses and 20% select carcasses have no adjustment.

Other Quality Grade Ranges	Applicable Adjustment
• If more than 80% of the carcasses grade choice and prime:	The Hot Carcass Weight of choice/prime carcasses comprising the excess shall receive a premium at the Choice/Select Spread (excess choice/prime carcass weight multiplied by the Choice/Select Spread.)
• If less than 80% of the carcasses grade choice and prime:	The Hot Carcass Weight of carcasses comprising the deficiency shall receive a discount at the Choice/Select Spread (deficiency in choice/prime carcass weight multiplied by the Choice/Select Spread.)
• Carcasses not grading prime, choice, or select ("ungraded"):	The Contract Base Price shall not apply to these carcasses. Such carcasses shall be priced at the Current Cash Price for non-graded Holsteins.

Carcass or Offal Damage Adjustment - Carcasses with damage to more than 10% of the total carcass due to yellow fat, bruises or grubs will be discounted at the Prevailing Discount Rate for such damage. If more than 20% of the Holsteins have the livers condemned, the excess condemnations will result in a discount at the Prevailing Discount Rate. Other damage including injection site lesions, abscesses of any kind, etc, will result in discounts at the Prevailing Discount Rate. Hide damage due to branding will receive a $5.00/head discount.

Age Adjustment – Carcasses judged to be from cattle 30 months of age and older will result in discounts of $5.00/Cwt of Hot Carcass Weight.

Yield Grade Adjustment
Carcasses which receive Yield Grades 1, 2 or 3 have no Yield Grade Adjustment

Yield Grade Range	Applicable Adjustment
• If more than 5% of the carcasses receive a Yield Grade 4:	The Hot Carcass Weight of Yield Grade 4 carcasses comprising the excess shall be discounted $10.00 per Cwt (Hot Carcass Weight multiplied by -$10.00/Cwt)
• Carcasses which receive a Yield Grade 5:	The Hot Carcass Weight of all Yield Grade 5 carcasses shall be discounted $20.00 per Cwt (Hot Carcass Weight multiplied by -$20.00/Cwt)

Muscle Score Adjustment
Carcasses which receive a muscle score of 1 or 2 will have no Muscle Score Adjustment

Muscle Score	Applicable Adjustment
• All carcasses which receive a muscle score of 3, which is defined as a carcass that either has 1) poor round conformation, 2) a shallow loin, 3) a shallow ribeye size as measured ¾ inch from the chime bone, or 4) carcasses under 850 pounds which have a ribeye size of less than 1 square inch plus 1 square inch per cwt., and carcasses over 850 pounds with a ribeye size of less than 10.5 square inches.	The Hot Carcass Weight of all muscle score 3 carcasses shall be discounted $5.00 per Cwt (Hot Carcass Weight multiplied by -$5.00/Cwt)
• All carcasses which receive a muscle score of 4 (which is defined as a carcass with **very** poor round conformation, sunken loin and a triangular or very small ribeye):	The Hot Carcass Weight of all muscle score 4 carcasses shall be discounted $10.00 per Cwt (Hot Carcass Weight multiplied by -$10.00/Cwt)

Carcass Yield - The parties understand that the Contract Base Price per Cwt is based on Delivered Weight and is for cattle yielding 59.5%. Calculation of proceeds for cattle delivered under this Agreement will be performed using a dressed base price (Contract Base Price divided by 59.5%) times the Hot Carcass Weight. By way of example and not limitation, a contract with a Contract Base Price of $85.00 per cwt (Delivered Weight) would have a dressed base price of $142.86 per cwt (Hot Carcass Weight) ($85.00 divided by 59.5%).

SAMPLE ONLY

Contract Number: OHECO ________

HIGH ENERGY HOLSTEIN CATTLE DELIVERY CONTRACT

This agreement (together with any exhibits, the "Agreement") is dated as of this ___ day of ________, 200_, by and between JBS USA, LLC, a Delaware limited liability company (including its subsidiaries and affiliates, "JBS"), 1770 Promontory Circle, Greeley, CO 80634 and [Seller Name] ("Seller"), [Seller Address].

The parties have entered into this Agreement as of the date first written above. Signatures below show agreement of the parties for all details of the Agreement and Exhibit A shown above and to follow:

JBS:	SELLER:
______________________________	______________________________
Name:	Name:
Title:	Title:

PLEASE BE AWARE:
This Agreement will be priced automatically at the Pricing Deadline unless previously priced by you or Converted at your direction.

PREMISES

JBS confirms the purchase from Seller of Holstein steers (each, a "Holstein") in the quantities, and subject to the terms and conditions, provided in this Agreement.

AGREEMENT

NOW, THEREFORE, the parties agree as follows:

Units Contracted this Agreement:	
Each Unit contains 47,000 pounds which is an estimated 31-38 head	
Delivery Month:	
Delivery Location:	
Futures Price (per Cwt):	
Futures Basis (per Cwt):	
Five Area Basis (per Cwt):	
Contract Base Price (per Cwt):	

1. Purchase Price; Payment and Title.

(a) The sum of all Holsteins delivered pursuant to this Agreement with a total Delivered Weight from 45,600 lbs to 48,400 lbs, as delivered in fulfillment of each Unit, shall be purchased at the Contract Base Price. Delivered Weight in excess of 48,400 lbs, as delivered in fulfillment of each Unit, shall be purchased at the Current Cash Price. The purchase price of all Holsteins purchased pursuant to this Section shall be subject to the Adjustments set forth in Exhibit A hereto, which is incorporated by reference.

(b) Seller shall be responsible for communicating its pricing instructions to JBS, from the options provided by JBS, to enable JBS to determine the Futures Price for the Holsteins. If the Futures Price has not been determined on or before the Pricing Deadline, the Futures Price will be the settlement price of CME's Live Cattle Futures on such date, unless the Seller has Converted the Agreement prior to the Pricing Deadline. See 5.(c) for details of pricing in this situation.

(c) Seller shall be paid all amounts owed hereunder at the end of the business day immediately following the day the final grading results of all the Holsteins are available to JBS. JBS shall have the right to offset any amounts owing to Seller hereunder against liability arising from Seller's indemnification obligation in Section 4 and/or arising from any other agreement between JBS and Seller. No advance payments will be made hereunder.

(d) Title to each Holstein delivered hereunder shall pass immediately to JBS upon the last of the following: (i)JBS's final grading of the Holstein carcass; (ii)JBS's determination that the Holstein was alive, healthy and in good and merchantable condition immediately prior to slaughter; and (iii)JBS's determination of all applicable Adjustments. JBS will not purchase Holsteins which are ill, injured, are condemned prior to or after slaughter, or which die prior to slaughter.

(e) All references to money in this Agreement are in US Dollars.

2. Inspection and Delivery of the Holsteins.

(a) Seller shall confer with JBS regarding the readiness of the Holsteins for delivery and will allow JBS (or its representative) to perform inspections of the Holsteins prior to their delivery. Any Holstein determined by JBS in its sole discretion to be unacceptable will not be purchased or delivered hereunder.

(b) Seller shall only deliver the Holsteins to JBS during the Delivery Month on a day designated by JBS. Holsteins may only be delivered outside the Delivery Month if agreed to in writing by JBS and then subject to Section 4(b).

(c) The Holsteins shall be weighed by JBS at or after arrival at the Delivery Location.

3. Seller's Representations and Warranties.

As an inducement to JBS to enter into this Agreement, Seller represents and warrants to JBS the following:

(a) Seller is a "merchant" as such term is defined in the Uniform Commercial Code (UCC) of the United States of America, with respect to the Holsteins, which are the subject of this Agreement.

(b) All Holsteins have been born and raised exclusively in the United States, are under 30 months of age, shall be delivered in good and merchantable condition and are suitable for immediate slaughter to produce meat for human consumption.

(c) All Holsteins delivered to JBS pursuant to this Agreement have been fed a High Energy Ration for a minimum of 350 days prior to delivery hereunder, beginning when such Holsteins weighed between 250 and 350 lbs

(d) Seller has good and merchantable title to and has full power and authority to sell the Holsteins and the Holsteins are sold free and clear of all Liens. If JBS receives written notices of Liens on the Holsteins from Lienholders or learns of Liens by its search of the governing state's central filing system, Seller authorizes JBS to make settlement under this Agreement jointly with the Seller and the Lienholders or directly to the Lienholders.

4. Seller's Indemnification Obligations.

(a) General Indemnification Obligation: Seller agrees to indemnify and hold JBS harmless from and against any and all claims, causes of action, damages, losses, liability, proceedings, judgments, actions, costs and expenses (including attorney's fees and proceeding costs) arising from or relating to Seller's breach of any terms, representations or warranties of this Agreement.

(b) Delivery and Hedging Indemnification: Seller acknowledges and agrees that Seller's failure to deliver the Units of Holsteins in the Delivery Month and at the Delivery Location provided in this Agreement may result in substantial financial injury to JBS, including losses incurred by JBS in connection with JBS's hedging its price risk for the Holsteins purchased hereunder by the use of futures and options (each, a "Hedge") on the Chicago Mercantile Exchange. In the event that Seller fails to perform as provided in this Agreement, JBS may exercise all rights and remedies available to it in contract, law or otherwise, including, without limitation: (i) all reasonable expenses incurred in obtaining each replacement Holstein, including any additional cost of the replacement Holstein; (ii)any losses arising from lifting its Hedge; and (iii) all expenses incurred in connection with collecting from Seller any amounts owing hereunder including, without limitation, reasonable attorney's fees.

5. Definitions.

(a) "Adjustments" means premiums and discounts from the Contract Base Price, as outlined in this Agreement and Exhibit A.

(b) "Choice/Select Spread" means the difference in value of choice beef and select beef for the 600 to 900 weight category published in the USDA Boxed Beef Report for the week immediately preceding the slaughter date.

(c) "Contract Base Price" is an amount equal to the Futures Price plus the Futures Basis or, if the Agreement has been Converted by Seller, the Contract Base Price is an amount equal to the Five Area Price plus the Five Area Basis.

(d) "Converted" means the direction given by the Seller to JBS's contracting department to, once and for all, convert the unpriced Agreement so Holsteins will be priced at delivery based on the Five Area Price and Five Area Basis, instead of the Futures Price and Futures Basis. Converted Agreements may not be priced using a Futures Price.

(e) "Current Cash Price" means the cash price for like Holstein cattle available in the marketplace at the Delivery Location at the time of slaughter.

(f) "Cwt." means hundredweight.

(g) "Delivered Weight" means the weight of the Holsteins weighed by JBS at or after arrival at the Delivery Location.

(h) "Delivery Location" means JBS's processing facility in the city and state indicated in the chart at the beginning of this Agreement to which Seller, at its own expense, shall deliver the Holsteins.

(i) "Delivery Month" means the calendar month chosen by the Seller (as indicated in the chart at the beginning of this Agreement) in which the Holsteins will be delivered to JBS at the Delivery Location.

(j) "Five Area Basis" means the value established by JBS at the time the Agreement is executed which will represent the premium or discount to the Five Area Price (see 5.(c) for details on when this applies in pricing of Holsteins under this Agreement).

(k) "Five Area Price" means the stated Average Price of Live FOB Steers in Weekly Weighted Averages section of 5 Area Weekly Weighted Average Direct Slaughter Cattle report (LM_CT150) as published by USDA covering the week ending on the Sunday prior to slaughter. If there are less than 50,000 steers and heifers confirmed in this section of the report, the Five Area Price will be the Average Price from the prior week's report. If USDA discontinues this report, JBS will use the USDA published price it deems is most appropriate.

(l) "Futures Basis" means the value established by JBS at the time the Agreement is executed which represents the premium or discount to the Futures Price (see 5.(c) for details on when this applies in pricing of Holsteins under this Agreement).

(m) "Futures Price" means the price level of the Chicago Mercantile Exchange (CME) Live Cattle Futures Contract, at the time this Agreement is priced, for the CME trading month which corresponds to the Delivery Month as shown in the following table:

Delivery Month	Pricing Based on CME Trading Month
January and February	February
March and April	April
May and June	June
July and August	August
September and October	October
November and December	December

(n) "High Energy Ration" means feed suitable for consumption by the Holsteins containing a minimum 64 Mcal NEG/100kg (dry matter basis) and containing not more than 10% roughage.

(o) "Hot Carcass" means a Holstein carcass immediately after slaughter at hot weight scale.

(p) "Hot Carcass Weight" means the weight of the Hot Carcass.

(q) "Lienholders" means holders of Liens.

(r) "Liens" means liens or encumbrances of any kind placed upon cattle as provided by law.

(s) "Prevailing Discount Rate" means the rate of discount normally applied by the Delivery Location at time of slaughter for similar adjustments.

(t) "Pricing Deadline" means the close of CME trading on the last trading day prior to the 15th day of the month preceding the Delivery Month.

(u) "Unit" means 47,000 lbs of Delivered Weight.

6. Force Majeure. Neither JBS nor Seller shall lose any rights hereunder or be liable to the other for damages or losses on account of failure of performance by a party (the "Defaulting Party") if such failure is occasioned by government action, war, fire, earthquake, explosion, flood, strike, lockout, embargo, or act of God beyond the control of the Defaulting Party; provided that the Defaulting Party claiming the force majeure has exerted all reasonable efforts to avoid or remedy such force majeure.

7. Confidentiality. JBS and Seller each hereby agree to keep confidential all of the terms and conditions of this Agreement, and to not divulge any of the terms hereof to any third party without first obtaining the express written consent of the other party unless otherwise required by law. Notwithstanding the foregoing, each party may disclose the terms and conditions of this Agreement to its key advisors, partners, agents and representatives of any corporate parent, investor, affiliate or subsidiary on a need to know basis.

8. Entire Agreement. This Agreement contains the entire agreement between the parties and shall be binding on the heirs, successors and assigns of the parties. Neither this Agreement, nor rights and obligations hereunder, may be assigned (by operation of law or otherwise) by Seller without JBS's prior written consent. SELLER AGREES TO SELL THE HOLSTEINS TO JBS IN ACCORDANCE WITH JBS'S REQUIREMENTS, SPECIFICATIONS AND PROCUREMENT POLICIES, AND JBS AGREES TO PURCHASE THE HOLSTEINS FROM SELLER IN ACCORDANCE WITH THE TERMS OF THIS AGREEMENT, THE TERMS AND CONDITIONS OF WHICH SHALL BE LEGALLY BINDING ON BOTH PARTIES. This Agreement must be signed and returned within ten (10) business days of receipt by Seller.

9. Waiver of Damages. JBS and Seller hereby voluntarily, knowingly, irrevocably and unconditionally (i) agree that damages shall be limited to actual and compensatory damages, and (ii) waive any right to claim or recover from the other party any special, exemplary, punitive, indirect or consequential damages, in the case of the foregoing (i) and (ii) for any claim (including contract, tort and all other claims) between or among JBS and Seller arising out of or in any way related to this Agreement, or other related document, or arising out of or in any way related to the transactions contemplated by this Agreement or other related document.

10. COUNTERPARTS. This Agreement may be executed in multiple counterparts each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument.

EXHIBIT A - ADJUSTMENT SCHEDULE

The following adjustments pertain to contract specifications on cattle delivered to JBS and shall adjust the proceeds due Seller.

Weight Adjustment
Hot Carcasses weighing from 700 lbs to 1000 lbs have no Weight Adjustment

Other Hot Carcass Weight Ranges	Applicable Adjustment
• Each Hot Carcass below 700 lbs.	$15.00/Cwt. discount of Hot Carcass Weight
• Each Hot Carcass over 1,000 lbs.	$15.00/Cwt. discount of Hot Carcass Weight

Quality Grade Adjustment
Units with 70% choice and prime carcasses and 30% select carcasses have no adjustment.

Other Quality Grade Ranges	Applicable Adjustment
• If more than 70% of the carcasses grade choice and prime:	The Hot Carcass Weight of choice/prime carcasses comprising the excess shall receive a premium at the Choice/Select Spread (excess choice/prime carcass weight multiplied by the Choice/Select Spread.)
• If less than 70% of the carcasses grade choice and prime:	The Hot Carcass Weight of carcasses comprising the deficiency shall receive a discount at the Choice/Select Spread (deficiency in choice/prime carcass weight multiplied by the Choice/Select Spread.)
• Carcasses not grading prime, choice, or select:	The Contract Base Price shall not apply to these carcasses. Such carcasses shall be priced at the Current Cash Price for non-graded Holsteins.

Carcass or Offal Damage Adjustment - Carcasses with damage to more than 10% of the total carcass due to yellow fat, bruises or grubs will be discounted at the Prevailing Discount Rate for such damage. If more than 20% of the Holsteins have the livers condemned, the excess condemnations will result in a discount at the Prevailing Discount Rate. Other damage including injection site lesions, abscesses of any kind, etc, will result in discounts at the Prevailing Discount Rate. Hide damage due to branding will receive a $5.00/head discount.

Age Adjustment – Carcasses judged to be from cattle 30 months of age and older will result in discounts of $5.00/Cwt of Hot Carcass Weight.

Yield Grade Adjustment
Carcasses which receive Yield Grades 1, 2 or 3 have no Yield Grade Adjustment

Yield Grade Range	Applicable Adjustment
• If more than 5% of the carcasses receive a Yield Grade 4:	The Hot Carcass Weight of Yield Grade 4 carcasses comprising the excess shall be discounted $10.00 per Cwt (Hot Carcass Weight multiplied by -$10.00/Cwt)
• Carcasses which receive a Yield Grade 5:	The Hot Carcass Weight of all Yield Grade 5 carcasses shall be discounted $20.00 per Cwt (Hot Carcass Weight multiplied by -$20.00/Cwt)

Muscle Score Adjustment
Carcasses which receive a muscle score of 1 or 2 will have no Muscle Score Adjustment

Muscle Score	Applicable Adjustment
• All carcasses which receive a muscle score of 3, which is defined as a carcass that either has 1) poor round conformation, 2) a shallow loin, 3) a shallow ribeye size as measured ¾ inch from the chime bone, or 4) carcasses under 850 pounds which have a ribeye size of less than 1 square inch plus 1 square inch per cwt., and carcasses over 850 pounds with a ribeye size of less than 10.5 square inches.	The Hot Carcass Weight of all muscle score 3 carcasses shall be discounted $5.00 per Cwt (Hot Carcass Weight multiplied by -$5.00/Cwt)
• All carcasses which receive a muscle score of 4 (which is defined as a carcass with **very** poor round conformation, sunken loin and a triangular or very small ribeye):	The Hot Carcass Weight of all muscle score 4 carcasses shall be discounted $10.00 per Cwt (Hot Carcass Weight multiplied by -$10.00/Cwt)

Carcass Yield - The parties understand that the Contract Base Price per Cwt is based on Delivered Weight and is for cattle yielding 61.0%. Calculation of proceeds for cattle delivered under this Agreement will be performed using a dressed base price (Contract Base Price divided by 61.0%) times the Hot Carcass Weight. By way of example and not limitation, a contract with a Contract Base Price of $83.00 per cwt (Delivered Weight) would have a dressed base price of $136.07 per cwt (Hot Carcass Weight) ($83.00 divided by 61.0%).

7 Habits of Highly Productive Pastures

Rhonda R. Gildersleeve, Ph.D., University of Wisconsin Cooperative Extension

For many agriculture producers in the Upper Midwest, 2012 will be recalled as a memorable year, presenting both challenges and opportunities. Due to widespread drought and high feeding costs, the beef industry is taking another hard look at increasing feeding efficiency, including figuring out how to get the best returns possible from pastures, harvested forages, and crop residues. Many pastures will need some extra TLC in the coming year to overcome the extreme drought conditions of 2012. This winter, spend some time thinking about what is really important to optimize potential of your pastures and develop a game plan for making it happen.

Match pasture management goals with herd nutritional needs

Each farm has different goals for pastures and the management system must be designed to meet individual production, forage quality, economic and lifestyle needs. Here are a few questions to consider:

- *Who is my "customer"?* Whether the answer is your own beef cow herd, retained feeders, purchased stockers, grass finishing cattle, or a even commercial hay market, each of these "customers" will require particular goals in terms of the quantity and quality of pasture and/or harvested forage needed. Identify these goals and shape pasture management to produce the desired outcomes.
- *What are my resources?* Recognize both the opportunities and challenges for pastures on your farm and determine how best to optimize the resources available. Think about your farm's pasture and forage systems in terms of total annual production needs. Identify realistic production and quality targets in terms of animal stocking rates, length of grazing season, or potential forage yields as well as considering how production shortfalls will be addressed.
- *What can I do to improve efficiency and sustainability of my system?* How does pasture and forage production fit in with other farm enterprises? What are the opportunities to increase efficiency in relation to the resources, time, labor and capital available? What farm conservation or environmental improvements are needed? What will the pasture and forage production system look like in five years? In 10 years? In 20 years?

Optimize soil fertility

Attention paid to soil fertility increases capacity of pastures and harvested forages to tolerate suboptimal growing conditions such as variable weather patterns, insect pests or weed competition, resulting in more consistent forage production and quality. Soil fertility needs should focus primarily on the legume component, which generally requires a higher soil mineral status, particularly of phosphorus, potassium, calcium, magnesium, sulfur, and boron for optimal production. In addition, research indicates that pasture grasses also use applied nitrogen more efficiently when soil potassium and phosphorus status is in the optimal range.

Soil test pastures and hayfields every 3 to 4 years, focusing on maintaining or improving soil pH, potassium, phosphorus, and trace minerals such as sulfur and boron as recommended. Call your local County Extension office for assistance with interpretation of soil test results for soils in your area.

Go for the legumes

Legumes make significant contributions in both pasture- and harvested forage production systems, providing consistent forage yield, quality, and palatability. Legumes also fix nitrogen in symbiosis with rhizobial bacteria colonizing their root systems. Most legumes will need to be reseeded periodically, or allowed an extended rest period to set seed. Grazing management that encourages strong seedling growth must also be applied. Develop a consistent plan to maintain or improve productivity of legumes in your pastures and hayfields to reap the benefits of these forages across the farm.

Add Diversity to pasture and forage systems

Many producers choose to use simple grass: legume mixtures on pasture and forage acres. Recent research from Iowa and elsewhere suggests that forage mixtures should be varied across the farm landscape to maximize productive capacity. In the Driftless Region, with rolling topography and variable soils, increased pasture diversity can pay dividends not only in terms of production, but also address erosion concerns, provide management flexibility during dry summers on shallow soils, and optimize returns from harvested forage acres. Improved varieties of legumes and grasses are available that enable producers to develop custom seeding mixtures that fit well across a farm's resources. For those producers interested in developing their own seeding mixtures, a calculator is available online through the University of Wisconsin Forage Research and Extension website at: http://www.uwex.edu/ces/forage/.

Manage grazing to realize adequate pasture rest and residual plant heights

Pastures require periodic rest from defoliation and attention paid to residual heights post-grazing to maintain vigorous swards. Subdividing pastures not only builds in more rest for individual pasture areas, but increases flexibility of grazing management in terms of matching animal dry matter intake and quality requirements along with the opportunity to better manage residual dry matter left after grazing. Recent research from the US Dairy Forage Research Center has demonstrated that several cool grass species show improved seasonal forage yields and also respond the following spring with up to 10 days of earlier growth initiation when proper residual grazing heights are maintained. During periods of dry weather, forage residues also provide important cover to soils that can buffer soil temperatures and improve water infiltration when precipitation occurs.

Have a plan for seasonal forage gaps and unexpected weather events

Forages adapted to the Upper Midwest have definite seasonal patterns of quality and production. As producers, we must plan for those periods of minimal forage production as well as be prepared for unexpected losses to due weather fluctuations. Currently there is much renewed interest in the use of crop residues and annual forages and cover crops to help fill in expected forage gaps as well as provide emergency forage as needed. Developing a plan for including some of these options among the total pasture and forage resource inventory is recommended for many beef production scenarios.

Show me the money

Last but not least, the economic realities of high feeding costs in all sectors of the beef industry requires that producers continue to pay attention to the economics of various pasture and harvested forage alternatives. Pastures still reign as our best low cost opportunity to produce high quality and quantities of forage for beef production, but will do so only if the same amount of attention and effort are made as with other feed crops.

Beef Manure in Deep Bedded Confinement

By Dan Huyser, Ag Engineering Field Specialist ISUEO

Deep bedded housing is becoming more popular as a confinement option. Besides taking less space than sheltered open lots, the rate of gain is comparable and runoff isn't an issue. The costs of building tend to be less than slotted floor confinement, although there tended to be slightly less nutrients maintained in the bedded manure versus the pit waste. The chart below uses data from Purdue ID 101 to show the difference in nutrients lost in the manure in different housing systems.

	Percent Nutrients Lost		
	N	P2O5	K2O
Open lot	40-60%	20-40%	30-50%
Bedded pack	20-40%	5-10%	5-10%
Pit	15-30%	5-15%	5-15%

In samples taken at multiple operations, there was not a large difference in manure content from the samples taken from the pack, bedded apron, or from a stockpile. There were, however, differences between operations related to pack and overall management.

The type of bedding will alter the final nutrient content in the manure. Absorbency affects the amount needed. Oat straw and corn stalks are among the most absorbent, taking in up to three times their weight in water. Bedding that absorbs less liquid will require additional material to maintain dryness. High Carbon to Nitrogen ratio bedding, such as wood products, can alter the amount of Nitrogen available by tying it up in organic compounds.

Higher pen densities, while maximizing the use of space, require greater management. In ISU research trials, cattle performance was the same at 40, 45, and 50 square feet per head. However, as the area per head gets smaller, the bedding packs became harder to maintain. As the bedding becomes wetter, more nitrogen is lost through denitrification when oxygen starved bacteria pull oxygen from nitrate molecules allowing the release of nitrogen to the air.

Nutrient content will vary with the season. Cold weather decreases the amount of denitrification and volatilization of nitrates. Feed efficiencies and manure production change as the weather reaches extremes in moisture and temperature.

Feed formulation and bunk management may have a large impact on manure nutrients. Cattle will absorb the amount of nutrients they can use and pass the rest in their manure. Feed that is spilled and not eaten instantly contributes to manure nutrient variability.

Nutrients will be lost during storage in different ways. Stockpiles that are allowed to sit in the sun and rain have greater losses to volatilization and denitrification. Manure that is washed away takes the nutrients with it. Protecting the stockpile by placing it on areas safe from runoff is recommended. Covered storage reduces volatilization and denitrification.

With so many variables, it becomes difficult to use book values when figuring out rates for manure application to fields. The solution to this is TEST YOUR MANURE! Manure can be tested for N, P, and K for around $30.00. There are several labs in the Midwest that will do this. Tests over 3 or 4 years will show a trend of nutrient composition if the overall management has been consistent. These values will help in planning application rates and get the most benefit out of the manure.

Finishing animals produce approximately 9800 pounds of manure in 153 days. This equates to almost 10 tons of manure per animal space in a facility if it is kept full year round. In a year, on average, 122 pounds of Nitrogen, 76 pounds of P2O5, and 88 pounds of K2O are produced annually per animal space. At $0.42/lb for commercial N, $0.60/lb for P, and $0.49/lb for K, the manure is worth almost $140.00 per ton coming from the animal. With losses to volatilization and denitrification, as well as the dilution from bedding, actual value per ton will be less. Again, testing your manure will determine the real value.

Making the manure nutrients available in the field becomes the next consideration. Getting an even spread is important to giving all plants access to the N, P, and K from the manure. Calibrating manure equipment will aid in figuring out ground speed and PTO RPM's to achieve even application and get a consistent level on the field. Incorporation will not only increase nutrient retention, but will aid in improved distribution of the manure.

In beef manure, not all nutrients are available the first year. Generally, only 30-40% of the Nitrogen is available the first year with around 10% the second, and 5% the third. Some is tied up in organic forms so that it is never available. There is a 90-100% availability of K and 60-100% availability of P the first year. As an example, if manure was tested and the results came back at containing 18 pounds of Nitrogen, 10 pounds of Phosphorous, and 12 pounds of Potassium per ton, there would be only about 6 of N, 8 of P, and 11 pounds of K available the first year. If it was decided that Nitrogen was the nutrient most needed from the manure, application rates would be based on the amount of N is required to satisfy the crop requirements. If 120 pounds of nitrogen per acre is desired, then 20 tons of manure containing 6 pounds of available nitrogen that year would be used. The next year, there would be 10% of the nitrogen available or 20 tons x 1.8 lbs/ton which comes out to 36 pounds per acre from the first year's application. During the third year there would be 18 pounds per acre still available. Using current pricing for Nitrogen, this would be a $73.08 benefit per acre from a one-time application of manure on corn on corn ground. Adding in the value of P and K used by the crop, the application becomes worth $233.35 over three years.

There can be considerable value to manure from Deep Bedded Confinement facilities. Taking care to preserve the nutrients through proper management will maximize the benefit and value from this resource.

Winter Cow Feeding Strategies

W. Travis Meteer, University of Illinois Extension

Introduction

One of the largest costs for cow-calf producers is feed costs. Costs associated with feeding the producing beef cow represent over sixty percent of the total costs in a cow-calf production system and are the largest determinant of profitability for beef producers (Miller, et al., 2001). With recent increases in hay and grain prices, this percentage of total costs could be even higher.

The majority of feeding costs occur in the winter months when grazing is limited and pastures are not productive. Thus, improved winter feeding strategies can greatly impact profitability of the cow-calf producer. Despite this, producers have been slow to realize the benefits of improved winter feeding strategies because of low-cost grains and co-product feeds in past years. Low-cost commodities are simply not in the equation for feeding cows in 2013. Producers will need to investigate and implement improved winter feeding methods to maximize profitability in the coming years.

The historic drought of 2012 will have an effect on the cattle industry for many years to come. The situation presenting many cattlemen this year is unlike any they have dealt with in recent memory. While water is most likely the limiting factor in a drought, feed availability is a close second. Many cowherds are entering the winter in poorer condition due to limited forage availability in pastures this summer. This combined with low winter feed supplies could lead to more cow liquidation or poor calving and re-breeding results in 2013.

Providing a balanced, least-cost ration to the cowherd is ultimately the best management strategy. A balanced, least-cost ration can be formulated from a number of different feedstuffs. Product availability and transportation costs can result in numerous different least-cost rations within a region. Not all feedstuffs are ideal; balancing the pros and cons of feedstuffs is dependent on individual operations. An improved winter feeding strategy can result in numerous different systems, but at the end of the day an improved winter feeding system should result in lowering feed costs and an increase in opportunity for profits.

Feeding Hay

The traditional method of winter feeding the producing cow has been feeding hay. Feeding hay is often the preferred method of winter feeding due to ease of handling and simplicity. Arguably the most common winter feeding strategy in the Midwest is to offer unlimited access to hay. Unfortunately, it is one of the most expensive systems.

Limit-Feeding Hay

Hay waste is responsible for much of the increased costs associated with feeding hay ad libitum. Thus, in effort to reduce costs of feeding hay, waste must be reduced. University of Illinois' Orr Beef Research Center has hosted numerous trials looking at limit-feeding hay as a method of reducing waste and thus, an economical alternative to feeding unlimited access hay. A summary of 3 different experiments is discussed in the following paragraphs.

The following is a list of the experiments to be summarized. Experiment 1 (Miller et al., 2007) evaluated different time restrictions to hay (3h, 6h, 9h) against unlimited access (24h) in late-gestation cows. Experiment 2 (Cunningham et al., 2003) looked at time restricted access of hay (4h, 8h, 24h) in lactating cows. In Experiment 3 (Cunningham et al. 2003) researchers assessed feeding lactating cows ground hay at 80, 90, and 100% NRC requirement when Rumensin® was fed at 200mg/hd/d.

Restricting time of access to hay is a method of limit-feeding hay. This method is especially appealing to average or smaller sized producers that do not have the equipment or facilities to limit-feed hay by grinding and feeding in bunks. Restricting time of access has proven to decrease hay waste. In Experiment 1 (Miller et al., 2007), hay waste decreased linearly as time of access decreased. In Experiment 2 (Cunningham et al., 2003) hay waste was decreased numerically with restricted access, but was not found significant. Restricting time of access also decreases hay disappearance and hay intake. By decreasing intake do we sacrifice performance? In Experiment 1, which utilized late-gestating cows, all treatments gained weight. However, in Experiment 2, which used lactating cows, cows lost weight across all treatments. Thus, it is important to consider stage of production, hay quality, as well

as environmental factors when choosing to limit-feed hay. Hay quality and nutrient analysis is shown in Table 1.

Another method of limit-feeding hay is to feed ground hay in bunks. Experiment 3 (Cunningham et al., 2003) looked at feeding cows at 80%, 90%, and 100% of NRC requirement with Rumensin added at 200mg/hd/d. Cows in all treatments experienced a decrease in weight, but these differences were not statistically different. The fact that cows at 100% requirement lost weight suggests that requirements were under-estimated for this set of cows or feed analysis did not accurately represent the forage. This trial illustrates that limit-feeding hay with Rumensin can allow a producer to feed cows at 80% or 90% with similar

Table 1. Hay analysis for experiments [a](Miller et al., 2007) [b](Cunningham et al., 2003)

	Dry Matter Basis		
Item	Exp. 1[a]	Exp. 2[b]	Exp. 3[b]
Crude Protein, %	17.57	19.56	15.97
Acid Detergent Fiber, %	35.19	32.85	41.92
Neutral Detergent Fiber, %	45.00	44.11	50.03
TDN, %	62.25	63.79	57.86
Net energy of lactation, Mgcal/kg	1.34	1.41	1.17
Net energy of gain, Mgcal/kg	0.81	0.85	0.68
Net energy of maint., Mgcal/kg	1.39	1.43	1.23
Relative Feed Value	127	134	105
Calcium, %	1.08	1.12	1.18
Phosphorous, %	0.27	0.23	0.29
Magnesium, %	0.18	0.20	0.23
Potassium, %	2.17	2.00	1.63
Sulfur, %	0.23	0.23	0.17

Table 2. Effect of restricting time of access to hay on cow performance, hay disappearance, and manure production. (Exp.1, Miller et al., 2007)

	Treatments				P-value	
Item	3 hr	6 hr	9 hr	24 hr	Linear	Quad
Initial Wt., lb.	1254	1239	1243	1256	.81	.64
Final Wt., lb.	1373	1399	1434	1463	.10	.45
Wt. Change, lb.	119	160	191	207	<.01	.03
Hay disappearance, lb DM/hd/d[a]	17.6	24.4	29.2	34.1	<.01	<.01
Manure production, lb DM/hd/d[b]	11.6	14.9	19.6	22.7	<.01	.07
Fecal output, lb DM/hd/d[c]	5.9	9.2	10.3	9.2	<.01	<.01
Hay waste, lb DM/hd/d[d]	5.9	5.7	9.2	13.4	<.01	.70
Hay waste, %[e]	33.3	23.2	31.5	39.5	.21	.49
Intake, lb DM/hd/d	11.7	18.7	20.0	20.7	.03	.03
Digestibility, %	49.4	50.5	48.6	53.4	.48	.76

[a] Calculated as amount offered minus refusals
[b] Physical collection of manure from pens including hay waste
[c] Calculated from chromium concentration in feces
[d] Calculated by subtracting fecal output from manure production
[e] Calculated by dividing hay waste amount by hay disappearance

Table 3. Effect of time restriction to hay on cow and calf performance, hay disappearance, and manure production (Exp.2, Cunningham et al., 2003)

	Treatments				P-value	
Item	4 hr	8 hr	24 hr	SE	Linear	Quad
Initial BW, lb.	1370	1318	1381	30.6	.47	.21
Final BW, lb.	1245	1257	1337	33.3	.06	.89
BW Change, lb.	-125	-61	-44	24.6	.08	.17
Initial calf BW, lb.[a]	99	98	100	2.3	.64	.62
Final calf BW, lb.	255	251	258	11.0	.72	.75
Calf ADG, lb/d.	2.2	2.2	2.2	.08	.77	.75
Milk Production, lb. [b]	9.9	9.9	10.0	.53	.70	.85
Hay disappearance, lb DM/hd/d	22.4	32.1	35.6	1.36	<.01	<.01
Manure production, lb DM/hd/d[c]	13.9	18.7	22.9	3.30	<.01	.08
Fecal output, lb DM/hd/d[d]	11.8	14.7	16.5	1.65	.13	.41
Hay waste, lb DM/hd/d[e]	2.2	4.0	6.4	2.3	.27	.77
Hay waste, %[f]	9.8	13.0	18.1	11.0	.43	.87

[a] Calf Birth BW was used for initial BW
[b] Milk Production estimate was obtained using 12-h weigh-suckle-weigh technique
[c] Physical collection of manure from pens, includes hay waste
[d] Calculated from chromium concentration in feces
[e] Calculated by subtracting fecal output from manure production
[f] Calculated by dividing hay waste amount by hay disappearance

performance to cows fed 100% of their requirement.

Table 4. Effect of feeding ground hay at restricted levels on cow and calf performance, hay disappearance, and manure production (Exp.4,Cunningham et al., 2003)

	Treatments[a]			P-value		
Item	80%	90%	100%	SE	Linear	Quad
Initial BW, lb.	1334	1366	1354	35.6	.71	.62
Final BW, lb.	1270	1306	1308	31.8	.06	.89
BW Change, lb.	-64	-60	-46	15.2	.40	.78
Initial calf BW, lb.[b]	91	89	93	2.4	.68	.32
Final calf BW, lb.	213	210	216	14.3	.89	.79
Calf ADG, lb/d.	2.0	2.0	2.0	.09	.79	.97
Hay disappearance, lb DM/hd/d	25.5	27.7	30.3	.20	<.01	.35
Manure production,lb DM/hd/d[c]	9.0	9.9	11.0	1.49	.36	.94

[a] Rumensin® was included in all diets at 200mg/hd/d
[b] Calf Birth BW was used for initial BW
[c] Physical collection of manure from pens, includes hay waste

Research shows that limit-feeding hay can be an effective strategy to decrease over-consumption of hay during stages of production that correspond with lower requirements, can reduce hay disappearance and hay waste when feeding large round bales, and can decrease manure production. Decreasing over-consumption, reducing hay waste, and decreasing manure production can directly return dollars back to a producer's pocket. It is important to realize hay quality, stage of production, mature cow weights, and environmental factors all play a role in determining if limit-feeding-hay is a viable money-saving feeding strategy.

Bale Feeder Design

As previously stated, feeding hay ad libitum is the most popular winter feeding strategy in the Midwest. In most cases, hay is packaged into large round bales and fed in some type of feeder. Many different designs claim to reduce hay waste, thus prompting research in this area.

Buskirk et al. (2003) evaluated large round bale feeder design and the subsequent effect of hay utilization and hay waste. The study compared four different hay feeder designs: cone, ring, trailer, and cradle. All feeder designs resulted in similar cow intakes. However, the amount of hay wasted was different between designs. Hay waste was least to greatest in this order: cone, ring, trailer, and then cradle. The type of hay offered in this trial was second cutting alfalfa and orchard grass. The hay tested approximately 13% CP, 53% NDF, 35% ADF on a dry matter basis. This trial shows that feeder design does impact hay waste.

Table 5. Effect of feeder type on hay waste and cow intake (Buskirk et al., 2003)

	Feeder Type				
Item	Cone	Ring	Trailer	Cradle	SEM
Initial cow weight, lb.	1383	1389	1390	1385	9.5
Hay disappearance, lb DM/hd/d	26.4[x]	26.6[x]	30.5[y]	28.3[x y]	0.9
Hay waste, lb DM/hd/d	0.9[x]	1.5[y]	3.5[z]	4.2[z]	0.22
Hay waste, %[a]	3.5[x]	6.1[x]	11.4[y]	14.6[y]	0.8
Hay intake, lb DM/hd/d	25.3	25.1	27.0	24.2	0.9
Intake/cow BW, %	1.8	1.8	2.0	1.8	0.1

a Hay waste as a percentage of hay disappearance
xyz Within a row, least square means without a common superscript letter differ (P< .05)

A field trial conducted by Oklahoma State University and The Noble Foundation looked at hay feeder design and associated wastes. Four different feeder designs were evaluated: cone, sheet, ring, and poly. Hay waste for the feeders as listed in parenthesis: cone (5.3%), sheet (13.0%), ring (20.5%), and poly (21.0%). Costs were analyzed as well. They assumed a hay price of $116/ton or $70/bale. Assuming a producer with 30 cows will feed 180 bales in a season, the costs associated with hay waste were $667 (cone), $1,638 (sheet), $2,583 (ring), and $2,646 (poly) per season. It is easy to see that improved feeder designs like the cone-shaped hay feeder can save producers money by reducing hay waste.

Table 6. Effect of feeder design on hay waste and cost (Wells, Lalman)

	Feeder Type			
Item	Cone	Sheet	Ring	Poly
Waste, % bale wt.	5.3[x]	13.0[y]	20.5[z]	21.0[z]
Total waste, lb/bale	63.6[x]	156[y]	246[z]	252[z]
Cost of waste/bale, $*	3.71[x]	9.10[x]	14.35[y]	14.70[y]
Cost of wasted hay/month, $*	111.30	273.00	430.50	441.00
Cost of wasted hay/season, $*	66.7.80	1638.00	2583.00	2646.00

xyz Within a row, least square means without a common superscript letter differ (P< .05)
*Assuming $70 per 1,200 bale, feeding 180 bales per season

Cornstalk Feeding

In the Midwest, high prices received for corn and soybean commodities have demanded a shift in acres away from hay and pasture to row crop production. In a 2012, Illinois planted an additional 1,800,000 acres of corn and Iowa an additional 2,500,000 acres of corn when compared to 2001 (NASS, 2012). Obviously, there is an abundant supply of cornstalks in the Midwest. Can cornstalks be used to effectively feed cows?

Grazing Cornstalks

Two methods of utilizing cornstalks as cow feed are grazing or harvesting as baled forage. Grazing cornstalks is the preferred method of harvest because it is lower cost. Cost of fencing and making water available is always cheaper per acre than costs associated with feeding baled cornstalks (machinery, fuel, storage, manure removal, etc.).

Cornstalks alone can provide adequate nutrition for mid and late gestation females (Warner et al., 2011). Cows selectively graze cornstalks. They harvest the most palatable components first and the least palatable last. For the most part, cows select the components in this order: remaining corn grain, husks, leaves, and then stalks. In the case of cornstalks, palatability also corresponds with nutrition. The portions of the plant selected first are more nutritious than those selected later. This allows cows to meet requirements if enough grain, husks, and leaves are present. Higher stocking rates and poor weather conditions can result in less available grain, husks, and leaves. Grazing cornstalks without supplementation can be a low-cost method of winter feeding, however stocking rate and weather conditions play a role in the success of this strategy.

A field trial conducted at the University of Illinois' Dudley Smith Research Farm in 2008 demonstrated how grazing cornstalks supplemented with DDGS could be used as a low-cost feeding strategy. The trial compared strip-grazing management of cornstalks and different stocking rates. Similar results were seen across treatments as all cows gained weight and BCS. In this trial in which cows were supplemented and strip grazed, cornstalks served as a low-cost method of wintering cows. At the time of the trial DDGS was valued at $100/ton and total costs averaged $0.49/hd/d. If DDGS is valued at $275/ton, total costs average $0.84/hd/d. It is important to note that grazing cornstalks is dependent on fence and water availability. If a weather event results in heavy snowfall or ice, cornstalk grazing is likely not possible. In this situation cows will need to be offered baled forage. Nevertheless, supplementing cows grazing cornstalks can be far cheaper than drylot rations, further illustrating that cornstalks can be utilized as a low-cost alternative winter feeding strategy.

Table 7. Effects of strip grazing cornstalks and stocking rate on cow performance (Shike, Faulkner, Ballard, 2008)

Item	1 / acre (2 wk)	1.5 / acre (2 wk)	1.5 / acre (1 wk)
Initial BW, lbs	1260	1276	1272
Final BW, lbs	1343	1340	1318
BW Change, lbs	83	63	46
Initial BCS	5.4	5.4	5.3
Final BCS	5.8	5.7	5.8
BCS Change	0.4	0.3	0.4

Table 8. Effects of strip grazing cornstalks and stocking rate on costs (Shike, Faulkner, Ballard, 2008)

Item	1 / acre (2 wk)	1.5 / acre (2 wk)	1.5 / acre (1 wk)
Corn stalks ($10/acre), $/hd/d	$0.24	$0.16	$0.16
DDGS ($275/ ton @ 4 lbs/hd/d)	$0.55	$0.55	$0.55
DDGS feeding labor[a] , $/hd/d (1.5 hrs for all 192 hd)	$0.09	$0.09	$0.09
Fence moving labor[a] , $/hd/d (20 minutes – 2x or 5x)	$0.01	$0.01	$0.02
Total cost, $/hd/d	$0.89	$0.81	$0.82

[a] Labor @ 12/hr

Feeding Baled Cornstalks

In many cases corn fields are not fenced and water is not available. Cornstalks can be harvested from the field by baling. Baling cornstalks can provide an alternative to grazing, but additional costs exist. Additional costs associated with baling cornstalks include machinery, fuel, labor, and nutrient removal costs. It is important to realize and apply these costs to the cornstalk bale to accurately determine the cost of the feedstuff. Even with these additional costs, many times baling cornstalks still is more economical than purchasing other feeds.

Baled cornstalks are normally 3-5% CP and 45-54% TDN. It is important to sample and test for nutrient analysis as variability is high. Supplementation is necessary to balance rations using baled cornstalks. Even with supplementation costs, feeding baled cornstalks can be an economic alternative to feeding hay.

Table 9. Effect of winter feeding strategy on spring-calving beef cows (Braungardt et al., 2010)

	Treatments[1]					Contrast		
Item	AdLib Res	TMR	LowRes TMR	AdLib Hay	SE	1 vs. 2,3	2 vs. 3	1,2,3 vs. 4
Bale disappearance,[2] lb/d	12.9	-	-	32.3	-	-	-	-
DM disappearance,[3] lb/d	27.2	28.4	26.4	32.3	-	-	-	-
Initial BW, lb.	1408	1430	1470	1469	56.1	.17	.27	.77
Final BW, lb.	1370	1383	1445	1361	54.7	.14	.08	.18
BW Change, lb.	-38	-47	-25	-108	28.1	.89	.23	.04
Milk Production, lb/d	26.6	24.6	22.6	22.2	1.52	.10	.35	.12
Calf ADG, lb/d	2.6	2.5	2.6	2.6	.12	.37	.33	.62
First-service AI, %	55	50	47	36	6.7	.48	.81	.09

1 Treatments: 1) AdlibRes = 14.3 lbs. DDGS (ADM, Peoria, IL), free-choice corn residue bale; 2)TMR = 14.3 DDGS, 14.1 lbs. corn residue; 3) LowResTMR = 16.5 lbs. DDGS, 9.9 lbs. corn residue; 4) AdLibHay = free-choice alfalfa mixed hay.
2 Bale disappearance represents corn residue bale for treatment 1 and alfalfa mixed hay for treatment 4.
3 DM disappearance of coproduct and corn residue bale or alfalfa mixed hay, depending on treatment.
4 24hr milk production determined using the weigh-suckle-weigh technique at 53±14.9 postpartum.

Corn co-products such as CGF and DDGS work well for supplementing cornstalks. Shike et al. (2009) concluded that cornstalks supplemented with high levels of co-products (up to 75% of the diet) could effectively maintain cow weight, milk production, and reproduction in lactating mature cows. Economic feasibility of wintering lactating cows on cornstalks and co-products would greatly depend on price and availability of co-products.

Limiting waste is an issue with feeding cornstalk bales. Many times strategies to limit waste include bale processing and feeding a Total Mixed Ration (TMR). Bale processing and use of a TMR feeding system adds equipment costs to an operation. Braungardt et al. (2010) compared feeding strategy on feed costs for varying herd sizes. Hand feeding and feeding with equipment was evaluated. Equipment assumed for treatment 1, where cornstalks where fed ad libitum in feeders, was a feeder wagon. In treatment 2 and 3, where cornstalks were ground and fed in a TMR in a bunk, a grinder-TMR mixer (vertical mixer) was used. Cow performance is shown in Table 9 and feed costs are shown in table 10.

Table 10. Effect of winter feeding strategy on feed costs for varying herd sizes (Braungardt et al., 2010)

	Treatments[1]			
Item	AdLib Res	TMR	LowRes TMR	AdLib Hay
Feed Cost, [2] $/cow per day	1.40	1.45	1.48	2.50
Hand Feeding, [2,3,4,5] $/cow/d				
50 cows	2.19	-	-	-
100 cows	2.19	-	-	-
Tractor Feeding, [2,3,4,5] $/cow/d				
50 cows	3.58	3.90	3.93	3.21
100 cows	2.73	2.91	2.94	3.21
150 cows	2.44	2.58	2.61	3.21
200 cows	2.30	2.42	2.45	3.21
250 cows	2.21	2.32	2.35	3.21
300 cows	2.15	2.25	2.28	3.21

[1] Treatments: 1) AdlibRes = 14.3 lbs. DDGS (ADM, Peoria, IL), free-choice corn residue bale; 2)TMR = 14.3 DDGS, 14.1 lbs. corn residue; 3) LowResTMR = 16.5 lbs. DDGS, 9.9 lbs. corn residue; 4) AdLibHay = free-choice alfalfa mixed hay.
[2] Feed Prices: DDGS, $124/ton; alfalfa mixed hay, $131/ton; corn residue, $55/ton
[3] Hand feeding calculated for treatment 1 only at 1h/50 cows at $15.95/h.
[4] Tractor cost = $58.95/h (overhead, $23.10; fule, $19.90; labor, $15.95).
[5] Bale feeding estimated at 10 min/bale fed (2.4 corn residue bales/d per 50 animals, 3.6 alfalfa mix hay bales/d per 50 animals) using a tractor.
[6] Annual ownership cost of the feed wagon (treatment 1) was $4,009 and of the grinder-TMR (treatment 2&3) mixer was $6,014.

Utilizing cornstalks is a cost-saving advantage to high priced hay. Cornstalks supplemented with co-products can be utilized by both large and small producers. Smaller producers with less than 50 head need to be willing to bucket feed the co-product, because equipment costs would not be justifiable at this number of cows. If they are not willing to bucket feed, then hay may be the cheapest strategy. For producers running over 100 cows, the added cost of equipment is easily justified with the feed savings of grinding and feeding a TMR. Size of operation and labor situation does have an impact on the economic feasibility of winter feeding strategies.

Corn Silage

Drought conditions hurt corn yields and in some cases caused total failure to produce grain. In effort to salvage failed crops and fill the place of low hay production in 2012, many producers made corn silage. Corn silage has been used for cattle feed for years, but in the recent biofuels era corn silage use has diminished. Producers that have not fed corn silage for years or even at all will feed corn silage this year.

Feeding corn silage instead of hay requires a few mental adjustments. The moisture content is drastically different. Thus 100 tons of corn silage is not equivalent to 100 tons of corn silage. Corn silage is normally around 35% dry matter vs. hay which is usually in the 85% dry matter range. It is important to convert all feeds to dry tons to accurately compare inventory and price as well. Cowboy math tells us that 100 tons of 35% DM corn silage is 35 dry tons of feed, whereas 100 tons of 85% DM hay is 85 dry tons. Moisture content of corn silage is an adjustment for those that have not fed wet feeds in recent years.

Testing for nitrates and obtaining a nutrient analysis is extremely important when dealing with drought-stressed corn silage. Nitrate levels and nutrient analysis will ultimately determine feeding strategies for corn silage. Elevated nitrate levels will result lower inclusion rates of corn silage. Large amounts of variation in nutrient analysis exist in the corn silage from 2012. Testing corn silage is a no-brainer.

Corn silage, even if drought-stressed, would be good quality forage. Cows consume good quality forage at 2.5% of body weight. This means a 1400 lb. cow will consume 35 lbs. DM or 100 lbs. as-is of corn silage. Even assuming the lower TDN of drought-stressed corn silage, energy requirements would be surpassed at this intake. As a result, limit-feeding corn silage and supplementing protein would best match cow requirements. Using poor quality forages, corn silage and protein supplementation if need is a proven winter feeding strategy. Feeding corn silage ad libitum will in most cases result in overfeeding.

Conclusions

Winter feeding strategies have the capability to greatly impact profitability in cow herds. Various different feedstuffs can be used to meet cow requirements, but certain feeds will match operation size and labor better than others. Managing feed waste, incorporating low-cost, alternative feeds, and utilizing balanced, least-cost rations will result in lower feed costs. Lowering winter feed costs is vital to offsetting increasing input costs and thus can directly increase profitability.

References

Braungardt, T. J., D. W. Shike. D. B. Faulkner, K. Karges M. Gibson and N.M. Post. 2005. Restricting intake of forages: An alternative feeding strategy for wintering beef cows. Prof. Anim. Sci. 21:182.

Buskirk, D. D., A. J. Zanella, T. M. Harrigan, J. L. Van Lente, L. M. Gnagey and M. J. Kaercher. 2003. Large round bale feeder design affects hay utilization and beef cow behavior. J. Anim. Sci. 81:109.

Cunningham, T. C., D. B. Faulkner, A. J. Miller and J. M. Dahlquist. 2005. Restricting intake of forages: An alternative feeding strategy for wintering beef cows. Prof. Anim. Sci. 21:182.

Miller, A. J., D. B. Faulkner, R. K. Knipe, D. R. Strohbehn, D. F. Parrett, and L. L. Berger. 2001. Critical control points for profitability in the cow-calf enterprise. Prof. Anim. Sci. 17:295.

Miller, A. J., D. B. Faulkner, T. C. Cunningham, and J. M. Dahlquist. 2007. Restricting time of access to large round bales of hay affects hay waste and cow performance. Prof. Anim. Sci. 23:366.

The Dudley Smith Initiative, Dan Shike, Dan Faullner, and Ed Ballard. 2008. DSynergy: Evaluation of Stocking Rates and Strip-GrazingManagement of Cows Grazing Corn Residue with Distillers Grains Supplementation http://web.extension.illinois.edu/dsi/projectdetail.cfm?NodeID=4036&type=Research. (Accessed 13 December 2012.)

The Noble Foundation, Robert Wells and David Lalman. 2011. Hay feeder design can reduce hay waste and cost.http://www.noble.org/Global/ag/news-views/2011/10/hay-feeder design.pdf. (Accessed13 December 2012.)

Comparison of Housing Systems for Finishing Beef Cattle

Dan Loy, Iowa State University

Housing systems for finishing beef cattle is a topic of increased interest in the upper Midwest. Several factors have contributed to this including interest in improving animal comfort and performance with recent weather variability and increased scrutiny by regulatory agencies on runoff control in small and medium sized open lot facilities. Deep bedded housing systems have become increasingly popular over the last 10 years. Honeyman and Harmon (2011) estimated that by the end of 2011, there existed 466,000 head of capacity in Iowa of deep bedded finished cattle housing. Considerable construction of new facilities has occurred since that report and interest has increased in slotted floor confinement facilities due to improved nutrient and value retention in the manure and decreased bedding costs. This presentation will review expected differences among facility types in animal comfort and performance, key operational issues including construction and operating costs, environmental management and manure value.

Environmental factors affecting cattle comfort. Both cold stress and heat stress can reduce cattle comfort and decrease performance in the feedlot. Cattle do have the ability to tolerate cold if kept dry and out of the wind. Windbreaks, shelter, bedding and bedding management, and mound management in open lots all serve to improve the animal's ability to tolerate cold stress. During heat stress, shade, sprinklers, adequate water and improved air flow over the animal all can contribute to improved comfort. Of these shade provides the greatest relief during catastrophic heat stress events.

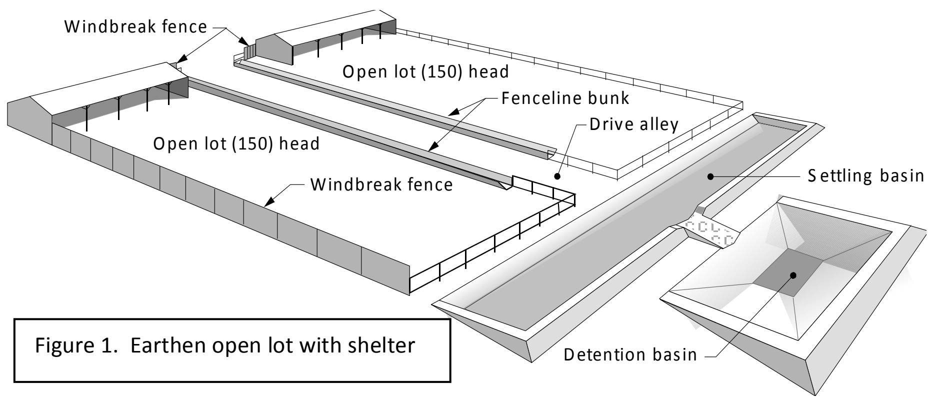

Figure 1. Earthen open lot with shelter

Types of facilities and performance differences. There are four basic types of facilities that are common in the upper Midwest for housing growing and finishing cattle. Of course there are variations on each of these and some "hybrids". These basic facility types (Lawrence et al., 2006) are shown in figures 1-4. The open dirt and concrete lots may be with or without shelter. The buildings in figures 3 and 4 may have a gable roof, mono-slope roof or hoop design. Feed alleys may

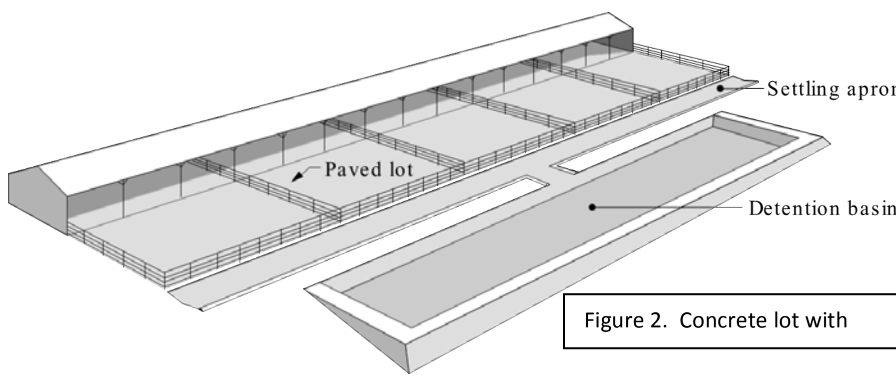

Figure 2. Concrete lot with

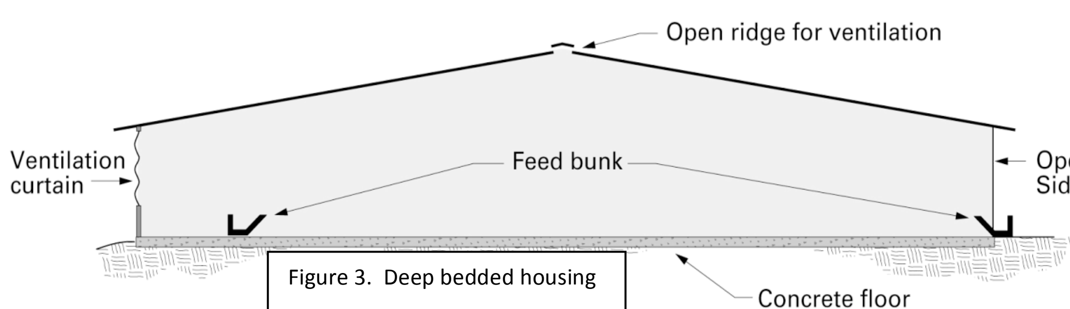

Figure 3. Deep bedded housing

be on one or both sides.

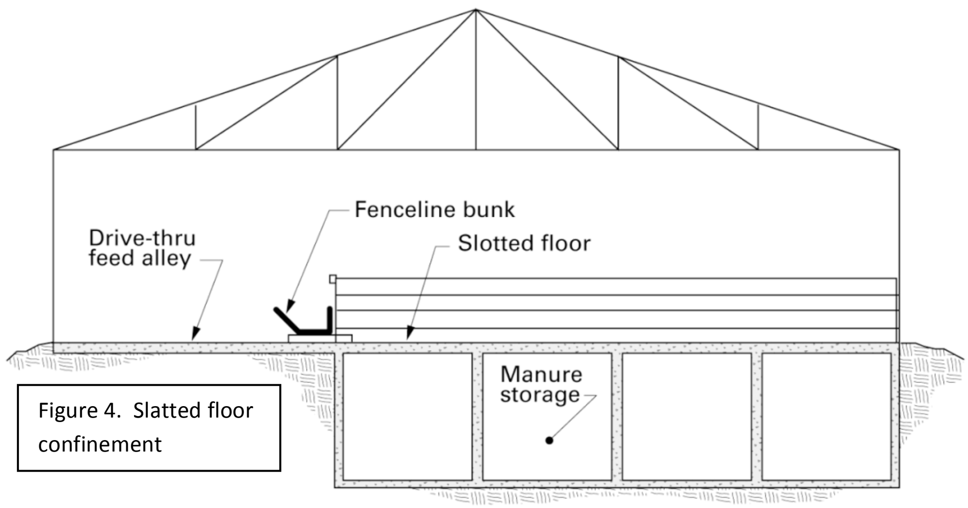

Figure 4. Slatted floor confinement

Previous research conducted in the 1970's, 80's and 90's resulted in an average year round performance response to shelter of a 5% improvement in feed conversion compared to no shelter in studies conducted in the upper Midwest. Those studies also noted a 3% improvement in feed conversion with confinement compared to open lots with some reduction in feed intake (Lawrence et. al., 2006). More recent comparisons have found no difference in performance comparing an open lot with shelter system to a hoop system (Honeyman et. al., 2009) and a 6.3% improvement in feed conversion comparing deep bedded housing and open lots with no shelter (Pastoor, et. al., 2012). A South Dakota comparison of open lots, open lots with shelter and a deep bedded mono-slope building found that the use of shelter improved feed conversion 2.8% (Holland et. al., 2011).

Construction and operational factors in comparing beef housing systems. Lawrence et. al. (2006) conducted an extensive comparison of feedlot systems in the "Beef Systems Feedlot Manual". Several assumptions were made in this analysis that may differ among individual producers. Also, key assumptions such as feed and bedding costs are out of date with current costs. Factoring in these differences a few key summary statements of the comparison can still be made. These are:

1. Confinement systems have the highest initial investment
2. Economies of size exist for runoff containment
3. Operational costs are highest with the deep bedded housing mostly due to bedding costs
4. The cost of shelter is justified in all systems
5. To capture the value of initial investments in confinement producers must also capture and utilize increased manure nutrient values.

References

Holland, B.P., E. R. Lowe and R. H. Pritchard. 2011. Cattle performance comparison in three feedlot designs in South Dakota. J. Anim. Sci. Vol. 89, E-Suppl. 1 (Abstract 550): 500.

Honeyman, Mark and Jay Harmon. 2011. Iowa hoop structures used for confined beef cattle feeding: a survey. Iowa State University McNay Memorial Research and Demonstration Farm 2011 Report (ISRF10-35).

Honeyman, M.S., J.D. Harmon, A.K. Johnson, D.L Maxwell, W.D. Busby, and S.C. Shouse. 2009. Beef cattle feeding in a bedded hoop barn: Three year summary. A.S. Leaflet R2403. Ames, IA: Iowa State University.

Lawrence, John, Shawn Shouse, William Edwards, Dan Loy, Joe Lally and Rachel Martin. 2006. Beef Systems Feedlot Manual. Iowa State University Extension Bull. PM-1867.

Pastoor, J. W., D. D. Loy, A. Trenkle and J. D. Lawrence. 2012. Comparing fed cattle performance in open lot and bedded confinement feedlot facilities. Professional Animal Scientist 28:410-416.

2013 Cattle Market Outlook: Challenges and Opportunities

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Drought and Cattle Numbers

The annual Cattle report, due out on February 1, 2013, is expected to show that the total inventory of all cattle and calves in the U.S. dropped just under 90 million head, the smallest total since 1952. Total beef cows likely will be 29.4 million head, the smallest beef cow herd since 1962. The 2012 calf crop was the 17th consecutively smaller calf crop and the 2013 calf crop will be smaller still, likely the smallest total U.S. calf crop since 1942.

Though delayed by drought the last two years, the squeeze in feeder cattle supplies has caught up with feedlots. Feedlot placements have been 1.33 million head below year earlier levels in the last seven months. Feedlot inventories will continue to drop as feeder numbers decrease even more this year and into 2014. If drought conditions persist, significant herd liquidation will happen again in 2013 and the brief increase in cattle sales may temporarily offset smaller cattle numbers followed by an even bigger deficit into the second half of the year and beyond.

Beef Production

Total beef production in 2013 is estimated to decrease 4.5 -5.0 percent year over year with a 5 percent decrease in cattle slaughter slightly offset by a one half percent increase in carcass weights. This follows a 1.1 percent decrease in 2012 beef production where a 3.3 percent decrease in cattle slaughter was significantly offset by a 2.3 percent increase in carcass weights.

Beef Demand

The production decreases projected above are expected to translate into a roughly 3.3 percent decrease in 2013 per capita beef supplies when adjusted for trade impacts. This magnitude of year over year decrease is similar to 2011 when retail prices increased 9.9 percent. In 2012, per capita beef supplies were almost unchanged from 2011 (when production was adjusted for trade) which led to a a 4.1 percent increase in retail beef prices. There will be plenty of pressure in 2013 for retail price to increase 10 percent or more but it is unclear if consumer demand will support increases at this level. Multiple times in 2012, wholesale Choice boxed beef prices approached but were unable to surpass the $200/cwt level. How fast and how much consumers can absorb higher retail prices is a key uncertainty in 2013 beef market outlook.

International Trade

Beef exports retreated by 12 percent from the 2011 record export level. Higher U.S. beef prices and reduced beef production are expected to further decrease U.S. beef exports slightly in 2012. However beef exports as a percent of total production will be mostly unchanged. Beef imports increased by a modest 6 percent in 2012, bolstered by higher U.S. beef values. Beef imports could increase by 11 percent year over year in 2013 with strong processing beef demand, reduced domestic supplies and higher values.

Industry Sector Outlook

Cow-calf

Production challenges clearly dominate considerations for many cow-calf producers. Calf and Feeder prices are likely to set new records in 2013 so prices are not the major issue. Surviving the drought and preserving financial resources for rebuilding are a major concern for many producers. For producers in drought areas as well as other producers, cost management will be the primary determinate of profitability against historically high calf prices.

Stocker

Stocker producers (including retained calves from cow-calf production) continue to see enhanced market signals to add additional weight to feeder cattle. These market signals are not so much about short term market conditions as much as the beginning of long term beef industry adjustments to higher grain prices. Long term beef industry competitiveness in the face of high grain prices means that the beef industry must some grain based production with forage based production which means enhanced stocker or backgrounding production.

Feedlot

Chronic excess feedlot capacity continues to plague the cattle feeding industry. Cattle feeders have endured huge losses with more to come as limited cattle numbers, record cattle prices and high feed costs combine to prevent feedlot profitability in general for the foreseeable future. The longer term industry adjustments to more forage and less grain based production imply that structural adjustment will continue for some time to come with some additional feedlot capacity exiting the industry.

Packer

Beef packers, like feedlots, have faced chronic excess capacity for many years. Limited cattle, struggling beef demand and near record fed cattle prices is likewise squeezing packer margins beyond endurance. The recent closure of a 1 million head per year plant in the Texas Panhandle is testament to the severe economic conditions of the packing industry.