Driftless Region
Beef Conference

Proceedings

January 26-27, 2017

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Corn crop harvest endpoints and profitability in the feedlot

Alfredo DiCostanzo, professor and Extension animal scientist, University of Minnesota, St. Paul

Cattle placements in feeding operations in Iowa, Nebraska and South Dakota increased steadily since 2010 (Figure 1). (Cattle placements in Minnesota also increased since 2010, but due to lack of complete data, placements for this state were not plotted.) This increase occurred in spite of the fact that the regulatory environment in these states is decidedly strict. Further, this increase occurred in spite of corn grain price, and prices of other feedstuffs also increased during this time period.

The region of the country encompassed by these states is characterized by having average to good quality soils with short growing seasons and extreme ranges in temperatures and weather events. Collectively, corn production by these states accounts for half of all the corn produced in the U.S. Also, given climate and topography is conducive for forage production; there were 4.7 million beef cows in Iowa, Minnesota, Nebraska and South Dakota in 2015. Neighboring states to the west and south of this 4-state region add to the beef feeder calf supply, and dairy calves may be procured from Minnesota, Wisconsin and other states. Therefore, the region represented by these states is well suited for, and is representative of integration of beef cattle production with crop production.

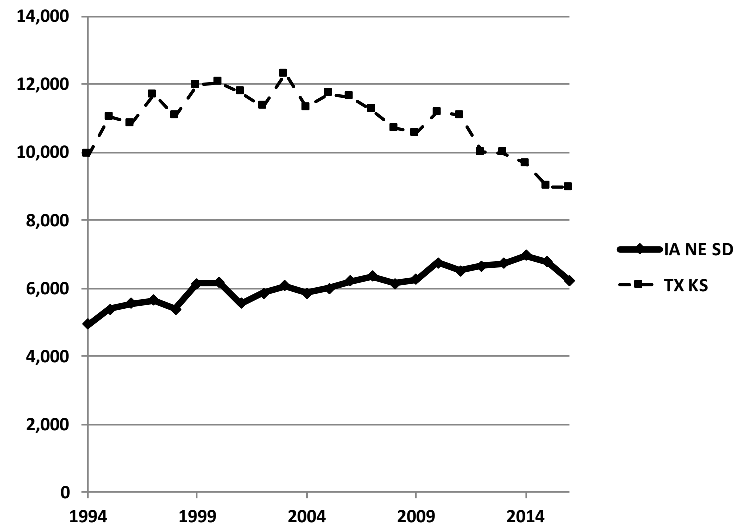

Figure 1. Yearly placements (x 1,000) in Iowa, Nebraska and South Dakota (dashed line) and in Texas and Kansas (solid line) since 1994.

Although a fair amount of research and discussion is published in various journals regarding integration of crop and livestock production, the focus of those works is mainly on grazing and cropping systems. Conclusions from reviews on the subject (grazing cattle and crops) demonstrated that incorporating cattle in cropping systems had positive impacts on soil quality, decreased reliance on external inputs, contributed to pest management, improved conservation of biodiversity and farm economies, and led to greater food security in communities where it was practiced (Hilimire et al., 2011). Scientific evidence for financial and environmental sustainability benefits of integrated crop and confined livestock production are lacking, and, given activists' and special groups' biased perception of sustainability, may not be well received.

It was hypothesized that cattle feeding operations represent a variance of crop and livestock production integration which yields similar impacts on soil quality, reduced reliance on external inputs, and improved farm economies with a greater feeling of food security in communities where it occurs. In this manuscript, the impact of corn crop harvest endpoint on performance and financial return to corn acres dedicated to cattle feeding was evaluated.

When prices of cattle, grains, roughage and fertilizer are known, gross return per acre dedicated to raising crops to feed and/or bed livestock may be determined by using cattle feedlot performance, manure nutrient value and corn grain and corn crop residue yield. Gross return (gross $/hd) was determined as the value remaining after subtracting non-corn crop expenses (cattle purchase, veterinary medicine, yardage, bedding and other non-corn grain or plant feed ingredients) from the value of gross cattle sales. Debits for corn crop residue removed for feed or bedding and credits resulting from manure fertilizer value applied to meet phosphorus need and adjusted for cost of removing and applying manure were applied. The resulting value is corn grain worth as cattle feed. Corn grain growth can be divided by bushels of corn used for feed to yield net worth of corn grain procured from land owned by the feedlot or cattle feeder. Alternatively, corn grain worth can be divided by acres used to raise corn grain to determine gross return to corn acres. Subsequently, if corn production costs are known, corn grain worth/acre may be subtracted from corn production costs/acre to generate net corn grain return to acres dedicated to cattle feeding.

Using this approach, net return per acre was obtained using historical cattle, fertilizer, corn grain and roughage prices, cattle performance and costs of raising corn grain on cash rental land in Minnesota for the most recent 21 corn grain and 18 cattle production years. Yearly net return per acre when corn grain was sold at the local elevator averaged $22 while that when corn grain was dedicated to cattle feeding averaged $136 (Figure 2). Given this sobering difference, it is no wonder cattle feeders, and other livestock operators, were excited to expand operations in these states in spite of the economic and regulatory climate. Financial institutions funding these operators must also understand these figures as large capital is required to operate these systems; capital that was lent at a time of high corn and land prices.

On the other hand, as modern forage and grain harvest and storage technology advances, questions regarding implications of opting for one of several corn crop harvest endpoints (silage, earlage, high-moisture corn or dry corn) on financial sustainability are raised by feedlot owners in the Midwest. A recent study (Johnson et al., 2016) was designed with heavy yearling steers fed individually to evaluate performance and interactions resulting from performance and crop yield when corn was harvested as either silage (CS), high-moisture ear corn (HMEC; earlage), high-moisture corn (HMC), or corn (DRC). Corn crop endpoints were harvested on a single field, which had been planted to the same variety. After harvesting end rows on the field, harvest of each corn crop endpoint proceeded across contiguous single-pass rows; the number of rows being defined by harvest equipment capacity and tonnage needed of each corn crop endpoint. This permitted harvesting the field from one end to the other while preventing bias due to fertility or plant conditions within the field. This field and 10 other fields were scouted from the tasseling stage to dry corn harvest; measurements of corn plant and plant constituent weights (fresh and dry) being taken at each crop endpoint.

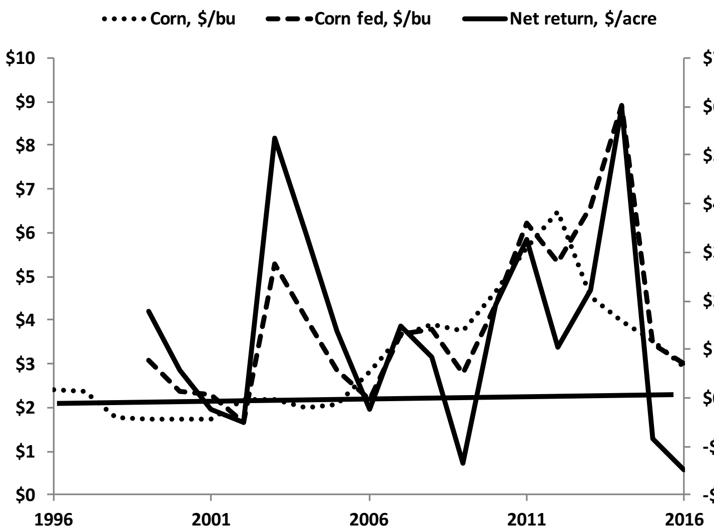

Figure 2. Calculated corn grain price when delivered to a local elevator ($/bu, dotted line) or realized after feeding cattle ($/bu, dashed line) and net return to corn acres allocated to cattle feed ($/acre, solid line and right vertical axis) for corn grain sold from 1996 to 2016 or fed from 1999 to 2016. Prices of cattle, grains, roughage and fertilizer were derived from USDA data. Gross return per acre dedicated to raising crops to feed and/or bed livestock was determined using cattle feedlot performance, manure nutrient value (Kenney-Rambo and DiCostanzo, 2016) and corn grain and corn crop residue yield (Johnson et al., 2016). Gross return (gross $/hd) was determined as the value remaining after subtracting non-corn crop expenses (cattle purchase, veterinary medicine, yardage, bedding and other non-corn grain or plant feed ingredients) from the value of gross cattle sales. Debits for corn crop residue removed for feed or bedding and credits resulting from manure fertilizer value applied to meet phosphorus need and adjusted for cost of removing and applying manure were applied.

After adapting 49 steers to consuming feed from individual Calan-Broadbent feeding stanchions, steers were randomly allocated to 1 of 4 dietary treatments representing each corn crop endpoint constituted 75% of diet DM. The remaining diet ingredients were 11% grass haylage, 10% modified wet distillers grains and solubles, and 4% liquid supplement. Given a diminishing supply of corn silage, actual corn silage concentration of the diet was 70%; the remaining diet ingredients were 13% corn grain (not drawn from the same field and accounted as purchased feed), 10% modified wet distillers grains with solubles, 4% liquid supplement and 3% grass haylage. Cattle had been implanted and were fed for 118 days.

Cattle fed HMC had the lowest ($P \leq 0.05$) DMI. Cattle fed DRC gained at faster ($P < 0.05$) ADG than cattle fed the other corn crop endpoints. Cattle fed HMC had greater ADG ($P < 0.05$) than those fed SIL. No difference between cattle fed DRC or HMC was observed for G:F, but feeding either led to greater ($P < 0.05$) feed conversion than feeding CS or HMEC. Final BW and HCW were greatest for DRC ($P < 0.05$), intermediate ($P < 0.05$) for HMC and lowest ($P < 0.05$) for HMEC and CS.

Corn grain worth was determined as indicated above for corn grain. Worth of corn grain was determined for CS, HMEC and HMC endpoints using corn grain content of each measured during scouting (Figure 3). There was no effect of corn crop endpoint for equivalent value of corn crop ($/bu). Harvesting corn as either CS, HMEC, HMC or DRC had no impact ($P > 0.05$) on crop worth (gross $ return/acre; Figure 3).

In spite of differences in DM yield for each of these crop endpoints, and differences in feed conversion, interactions between yield and feed conversion efficiency were such that no differences were realized for gross return per acre or equivalent value of the crop expressed as dollars per bushel of corn. This is the first study where an attempt has been made to determine gross return to corn acres or gross value of crop expressed as price of corn grain. Yet, information derived from it demonstrated that cattle feeders with access to corn cropland have flexibility in their choice of harvest endpoint. This may mean that cattle feeders may be able to combine corn crop endpoints to optimize ruminal fermentation of starch while retaining gross return to acres similar to that of planting corn for dry corn harvest.

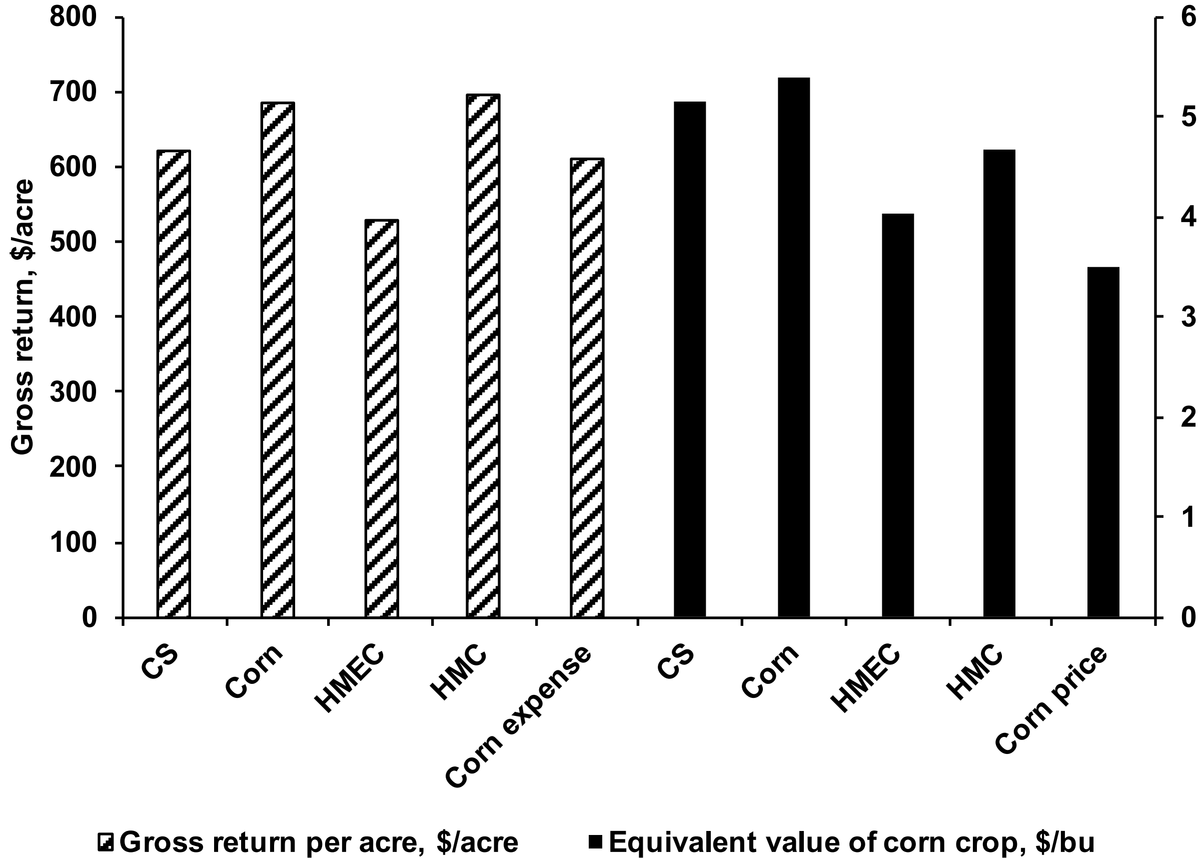

Figure 3. Gross return per acre or corn worth expressed as $/bu after feeding corn silage (CS), corn (fed as dry rolled), high-moisture ear corn (HMEC) or high-moisture corn (HMC) to yearling steers. Corn expense and corn price refer to the total dollars spent to plant, grow and harvest corn and market price at the time of analysis, respectively (Johnson et al., 2016).

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Myths and merits of grazing corn residue

Mary E. Drewnoski, Beef Systems Specialist, University of Nebraska

Corn residue is an abundant feed resource for Midwestern cattle in the winter and has been utilized by cattle producers for decades. However, there are some questions that consistently crop up every fall when cattlemen are looking to utilize this feed resource.

- What is the ideal stocking rate?
- Do cows need supplemental protein?
- Can corn residue be used to cost-effectively background calves?
- Is the corn residue from GMO corn lower in quality than non-GMO corn?
- Do cattle cause compaction when grazing on cropland?
- Will corn residue grazing impact subsequent crop yields?

This paper will provide answers to these questions based on interpretation of the available research data.

What is the ideal stocking rate and do cows need supplemental protein?

Stocking rate is extremely important because it affects the animal's plane of nutrition. When grazing corn residue, cattle select dropped corn grain along with the husks and leaves. Digestibility (energy; TDN) of the diet is quite high at the initiation of grazing, but declines with time (Figure 1) because cattle select the more digestible parts such as grain and husk early in the grazing period. The corn grain itself has more energy (83% TDN) and protein (9% CP) than any other plant part. Husk is about 60% TDN and leaf is about 50% TDN. Cattle consume cob and upper stalk (which are low energy; 35% TDN) only when availability of husk and leaf is limiting.

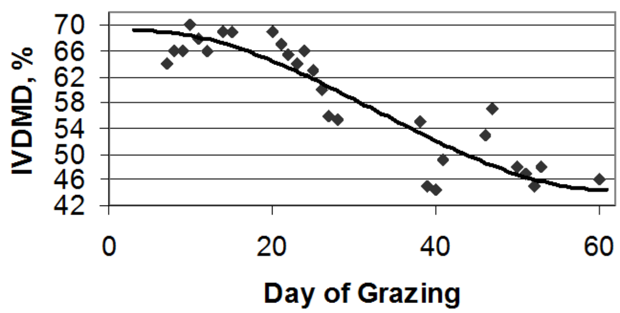

Figure 1. In vitro dry matter digestibility of the diets selected by esophageal fistulated calves grazing corn residue. Consumption of 50% of the available husk and leaf reached around d 50 (Fernandez and Klopfenstein, 1987).

This information has been the basis of stocking rate recommendations (remember other losses will occur such as wind and trampling loss). The general rule of thumb is that corn residue can be stocked at 1 cow (1200 lb) for one month for every 100 bu of corn (Table 1). At this stocking rate, cattle would be consuming half of the leaf and husk available which is only 15% of the total corn residue produced.

Table 1. Suggested stocking rates for grazing cows on corn residue based on corn yield

Corn Yield (bu/ac)	Animal Unit Month[1] (AUM)/ac	# of grazing days at one 1200 lb cow/ac
100	1.1	28
125	1.4	36
150	1.7	43
175	2.0	50
200	2.3	57
225	2.6	64
250	2.8	71

[1] One Animal Unit Month (AUM) is the amount of forage required to sustain a 1,000 pound cow or equivalent for one month

When cattle are stocked at the appropriate rate in one field for the entire winter, they have a high plane of nutrition early when they are eating more corn early in the winter, followed by a higher proportion of husk, and finally primarily leaves late in the winter. The problem with this system is that with spring-calving cows, requirements are increasing late in the winter because the fetus is starting to grow more rapidly. However, in a 5 year study, supplementation of a distillers based cube at 2.2 lb to cows grazing corn residue did not improve pregnancy rates or weaning weights over non-supplemented cows (Table 2) when grazed to the recommended stocking rate. Additionally, supplementation did not appear to have a fetal programing effect on the heifer progeny as replacement heifers born to cows grazing corn residue with and without supplementation had similar gains, age at puberty and pregnancy rates. At the start of the winter, the cows were in good BCS (BCS 5) and non-supplemented cows were able to maintain BCS over the winter when grazing residue alone.

Table 2. Impacts of supplementing 2.2 lb/d of a DDGS based cube to cows grazing corn residue. (Warner et al., 2012)

	SUPP	CON	*P*-value
Dam			
Oct BCS	5.4	5.4	0.89
Feb BCS	5.6	5.4	0.02
Preg rate, %	94	91	0.18
Calf birth wt, lb	86	86	0.27
Calf weaning wt, lb	548	552	0.35
Heifer progeny			
ADG, lb	0.97	1.01	0.20
Age at puberty, d	343	336	0.23
Preg rate,%	75	78	0.64

Stocking density can be used to influence an animal's plane of nutrition. Some producers use a higher stocking density and a shorter amount of time and move cows from field to field over the winter. With this type of grazing, the plane of nutrition cycles with nutrition being greatest at the start of a new field and then declining until they start in a new field again. This allows producers to provide a more nutrient-dense diet in late winter when spring calving cow's requirements are greater. Although there is a nutritional benefit to this strategy, there is also the risk of winter weather such as ice restricting grazing such that the cattle must be removed from residue grazing, resulting in some fields not being grazed.

If mature gestating cows are thin (BCS 4), they will respond to protein supplementation. Typically, we suggest feeding 0.3 lb of protein. This would be 1 lb of dry distillers or 2 lbs of modified distillers. This can allow thin cows to increase BCS before calving and may improve their rebreeding rates.

First calf heifers have the greatest nutrient requirements in the cow herd. First-calf heifers in mid-gestation (6 to 3 months prior to calving) will need protein supplementation at about 0.5 lb of protein/d when grazing corn residue. Supplementing about 1.8 lb/d of dry distillers will correct this deficiency. During late gestation (3 months prior to calving) first calf heifers are both deficient in protein and energy. Feeding 3.3 lb of dry distillers will meet their needs. Corn residue also can be used to cost effectively develop replacement heifers. Supplementation of 2 lb/d of dry distillers to 600 lb heifers will typically result in an ADG of 1 lb/d, and 4 lb/d of dry distillers results in ADG of 1.5 lb/d.

Plane of nutrition can also be increased by using lower stocking rates so that all of the corn and some husk is grazed, but cattle are removed before plane of nutrition declines significantly. This may be beneficial for grazing cattle with higher nutrient requirements such as thin cows, first calf heifers, and growing calves. However, supplementation will still be needed to achieve targeted performance for first calf heifers and growing calves (stockers and replacement heifers) and may be needed to get thin cows on proper condition before calving.

Because total intake, digestibility, and protein content of the diet declines during the grazing period, if greater than recommended stocking rates are utilized both supplemental energy and protein may be needed to maintain BCS of mature cows after they have reached the recommended stocking rate.

Can corn residue be used to cost effectively background calves?

In the Midwest corn residue and distillers grains provide a distinct advantage for growing calves in the winter. Due to the typical rental rates for corn residue and the cost of distillers, these two feed resources together make one of the lowest cost growing rations possible. In ruminant diets, not all protein is created equal and this can particularly become apparent for animals with high protein requirements such as growing calves. Ruminally degradable protein is used by rumen microbes to grow (which then become a source of protein themselves called bacterial crude protein) and degradable protein supplied in excess of the microbes requirements is converted to ammonia in the rumen which cannot be used by the animal as a source of protein. When the animal's protein need is high and the bacterial crude protein does not meet the animal's demand, then a source of undegradable protein is needed. A good example of this concept is the comparison of urea as a source of protein vs distiller grains for growing calves grazing corn residue (Table 3). Urea is 100% ruminally degradable whereas the protein in distillers is only 37% ruminally degradable meaning the 63% of the protein bypasses the rumen and can be absorbed and used as a source of protein for the animal itself. When a similar amount of energy and protein was supplied from corn plus urea vs. distillers grains, the performance of calves receiving distillers was more than double that of the calves receiving the corn plus urea.

Table 3. Effect of supplement and source of protein on calf performance when grazing corn residue

Supplement information	No Suppl.	Corn	Corn+ Urea (5%)	DDGS
DM, lb	-	3.75	4.0	3.0
TDN, %	-	83%	78%	104%
TDN, lbs	-	3.11	3.12	3.12
CP, lbs	-	0.37	0.92	0.90
Calf Performance[1]				
Initial BW	516	516	516	516
Ending BW	504[a]	539[b]	559[c]	629[d]
ADG	-0.18[a]	0.31[b]	0.53[c]	1.32[d]

[1]Means within row lacking common letters differ ($P < 0.05$)
Tibbitts et al, 2016

Distillers grains have consistently been the lowest cost source of bypass protein in the Midwest. In addition, distillers grains are very high in energy (greater than corn). Thus, distillers grains make an ideal low cost supplement for calves grazing corn residue. Table 4 provides the amount of distillers grains that would need to be fed to achieve various rates of gain based on data gathered from multiple trials where distillers grains have been fed to calves grazing corn residue. In forage based systems, we observe similar performance with dry, modified and wet distillers as long as the same amount of dry matter is fed. It is important to note that the estimates in Table 4 are based off of calves being fed in a bunk. Feeding on the ground will increase waste and thus increase the amount needed to be provided. In trials, evaluating the waste with ground feeding, waste of 5% was measured for modified distillers, 20% for wet distillers and as much as 40% for dry distillers when compared to bunk feeding.

Table 4. Amount of distillers supplementation needed for a 600 lb steer to achieve targeted rate of gain

ADG lbs/d	Lbs of DM	Lbs DDGS	Lbs MDGS	% BW
1.08	1.8	2.0	3.6	0.3
1.23	2.4	2.7	4.8	0.4
1.37	3.0	3.3	6.0	0.5
1.49	3.6	4.0	7.2	0.6
1.61	4.2	4.7	8.4	0.7
1.71	4.8	5.3	9.6	0.8
1.88	6.0	6.7	12.0	1.0
1.95	6.6	7.3	13.2	1.1

Assumes 90% DM for DDGS and 50% for MDGS
Based on Welchons andMacDonald, 2017

Is the corn residue from GMO corn lower in quality than non-GMO corn?

The digestibility of the forage selected by cattle has not been found to differ between transgenic and the non-transgenic parent. Additionally, in five different trial with various genetic modifications to the corn plant, the gain of calves (supplemented with distillers grains or corn gluten feed) grazing transgenic vs the parental hybrid was not different (Table 5). In fact the numerical differences in gain appeared to correlate with the amount of dropped corn in the field rather than with genetic modification. Ear drop may explain why some producers have felt that Bt corn has a lower feeding value. In cases where there iscorn borer pressure, the amount of dropped corn in non-Bt corn varieties may begreater resulting in greater feeding value for cattle grazing. However, this also means that less corn ended up going to market.

Table 5. Summary of five trials evaluating growing calf gain when grazing genetically modified (Bt or roundup ready) corn residue

		Calf gain, lb/d				Residual corn, bu/ac	
Trial	**Protein**	**TRAN**	**CON**	**Diff**	***P*-value**	**TRAN**	**CON**
Folmer, 2001	Bt (Cry1Ab)	0.54	0.70	-0.17	0.12	1.00	1.50
Wilson, 2003	RR (EPSPS)	1.28	1.05	0.23	0.07	2.30	1.60
Wilson, 2003	RR (EPSPS)	0.86	0.79	0.07	0.23	0.00	0.13
Wilson, 2003	Bt CRW (Cry3Bb1)	0.75	0.87	-0.12	0.31	0.29	0.58
Weber, 2011	Bt (Cry1A.105 + Cry2Ab2)	0.52	0.39	0.13	0.20	2.41	2.48

Do cattle cause compaction when grazing corn residue and will grazing impact subsequent crop yields?

Many crop producers have concerns that cattle trampling will adversely affect soil physical properties and subsequent crop productivity. Soil compaction, measured as an increase in bulk density or penetration resistance, influences the ability of a plant to acquire water, nutrients, and oxygen because of restricted soil water movement, oxygen and nutrient diffusion to roots, consequently reducing crop yield. Grazing in late fall or winter has very rarely resulted in biologically significant compaction on cropland. When compaction was measured, the effects were usually confined to the upper 0-2" of top soil and were thus short-lived due to natural processes of wetting-drying cycles, freezing-thawing cycles, root growth, and the activities of soil organisms. In one study, winter grazing of wheat residue increased bulk density of the top 2" when measured prior to corn planting but by the time the corn was at the six leaf stage, no difference in bulk density was observed.

Grazing of corn residue generally has no negative impact on subsequent crop yields. Grazing in the fall/winter or in the spring in a long term study (16 years) in eastern NE with fields managed in a corn-soybean rotation without tillage (no-till) did not result in detrimental effects on soil properties nor crop yields. In fact, grazing of corn residue improved soybean yields by 1.5 bu/ac for spring grazing and 3.4 bu/ac with fall grazing. In a western NE field managed in a continuous corn rotation, grazing of corn residue for a 5 year period did not affect corn yields (148 vs 154 bu/ac, for not grazed and grazed, respectively). Shorter term studies have shown similar results. A two year study with four locations in eastern NE reported that grazing had no impact on subsequent crop yields. Three locations were managed under a continuous corn rotation with subsequent corn yields of 239 bu/ac for grazed and 223 bu/ac for ungrazed (which did not statistically differ). One location was in a corn-soybean rotation with soybean yields not differing between grazed (59 bu/ac) and ungrazed (62 bu/ac).

It should be noted that an increase in surface roughness due to grazing has been observed, especially under wet soil conditions, in soils with low soil organic matter content, or intensive tillage (as these soils have less soil structure) which can sometimes impede seed placement. A study in SE Iowa evaluated the effects of grazing corn residue on fields managed under spring till or no-till in a corn-soybean rotation over a three-year period. Cows were moved to a new section of the field each month during the winter. Therefore, the impact of grazing was measured in 15 areas for each tillage treatment. There was only one instance when grazing had an effect on soybean yield. In this instance, they reported a reduction in soybean yields from 45 bu/ac to 41 bu/ac when corn stover was grazed in the no-till system. Bulk density was not affected. However, surface roughness was increased in this instance, suggesting seed placement may have been the cause of yield loss.

Grazing may provide some benefits when implemented consistently over a long period of time. After 16 years of grazing corn residue in the fall (FG) or spring (SG), an increase in the soil microbial community (Table 6) was observed (when compared to areas that were not grazed; NG). The effects on the soil microbial community may explain the improvement in soybean yields which was observed in the grazed treatments because an increase in soil microbes, actinomycete bacteria, and saprophytic fungi may increase the rate of nutrient cycling.

Table 6. Impact of 16 years of grazing in the fall (FG) or spring (SG) corn residue on soil microbial community as compared to no grazing (NG)

	Treatment				P-value
nmol/g of soil	NG	FG	SG	SEM	NG vs G
Total microbes	62.7	74.8	76.2	4.5	0.06
Bacteria	32.3	38.6	39.1	2.1	0.04
Actinomycete-bacteria	3.3	4.3	4.2	0.21	0.01
Micro-Eukaryote	2.0	2.3	2.1	0.16	0.30
Arbuscular mycorrhiza (AMF)	5.0	5.3	5.6	0.70	0.64
Saprophytic Fungi	3.1	4.0	4.2	0.28	0.03

Another concern is that grazing may reduce soil OM (due to residue removal) or result in the export of nutrients such as N, P and K. After 16 years of grazing, no differences in soil organic matter, N, P or K were measured. It is important to remember that most of the nutrients (such as N, P, K, Ca, etc.) consumed are excreted back on to the land. Additionally, grazing only removes a small percentage of residue (target 15%) and thus cover is maintained and erosion risk is not substantially increased. However, it should be noted that there are some corn fields which, due to topography (steep slopes) and/or low corn grain yield (especially in rotation with other low residue crops like soybeans) which should not be grazed by cattle because there is not enough residue present to provide adequate cover (even before grazing). Alternatively, grazing can be used as a residue management strategy for high yielding or continuous corn rotations where excess residue is a problem. The combination of the residue consumption and the increase in microbial activity may be beneficial in these fields.

Note: P-value (probability value) refers to the likelihood that the observed differences among means (treatment averages) are due to chance (thus the smaller the P-value the more likely there is a difference). Example: P = 0.05 suggests that there is a 5% chance that the differences observed between means are due to random chance.

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Best management practices to reduce reliance on antibiotics in cattle

Clifford F. Shipley, DVM, DACT; Attending Veterinarian for Agricultural Animals, Agricultural Animal Care and Use Program, University of Illinois

With recent changes in Food and Drug Administration (FDA) policy towards antibiotic use and the Veterinary Feed Directive (VFD) initiative, it is imperative that the cattle industry (and others) look at best practices to reduce reliance on antibiotics. Not only is this an effort to respond to concerns about antibiotic resistance, but changes how and when and if producers use antibiotics. We must look at how we can prevent disease, improve cattle welfare, maintain efficiencies and handle costs.

VFD

The VFD now requires certain compliances from the veterinarian, the producer and the feed mill.

Although not new (VFDs have been required for years for some products), it has taken the animal production industry time to respond and adapt to the new regulations. Many will struggle with this as we learn to adapt to the new regulations, writing VFDs and getting guidance from the FDA, as situations will arise that were not anticipated. The VFD applies to medically important antibiotics in humans and classifies them as important, highly important and critically important. Some antibiotics and most other classes of drugs used in animal production only such as ionophores or anthelmintics are not under the VFD.

This is not a tutorial on the VFD, but briefly, this will help explain VFD usage. It must be a medically important antibiotic. The veterinarian must be licensed in the state where the animals are located and the VFD feed is consumed. There must be a valid veterinary client patient relationship (VCPR) and no extra label use is allowed. The VFD can only be approved with other approved combinations and the Animal Medicinal Drug Use Clarification Act (AMDUCA) does not apply. There was an FDA ruling in December that allows some minor species use but still needs clarification (my opinion).

Prevention versus treatment

We have known for years that in most cases it is cheaper and better to prevent disease than to treat it. Not only do we save money, I believe it is an animal welfare issue to do less than our best to prevent disease. Through proper nutrition, reduction of stress, vaccination when appropriate for disease and having internal and external parasite controls go a long way towards preventing disease outbreaks that rob us of profits. Treating sick livestock is not much fun, even if you are a veterinarian!

At the University of Illinois, all our farms fall under the Institutional Animal Care and Use Program (IACUC). We also are accredited by AAALAC International, answer to the USDA for some parts of our program and have the Agricultural Animal Use and Care Program. Even with this oversite, we still are production-based farms. We have specific herd health programs for all the farms and written standard operating procedures (SOPS) for most health issues. We also have guidelines for importing new animals, isolation procedures, transportation and testing. These SOPs are reviewed yearly by researchers, production personnel, managers and veterinarians to ensure that we are following these guidelines, change or alter them if they are not working or need updating and to make sure everyone is communicating appropriately. Examples of these programs are at the end of these proceedings.

Vaccination programs to prevent disease

An appropriate vaccination program for your herd is one of the key elements of decreasing disease, treatments and the reliance on medications to prevent and control disease. Vaccine programs should be customized to fit your herd and the risks and benefits weighed carefully to optimize value. Cows and heifers should be on a program that limits reproductive, respiratory, systemic and enteric disease in both the adult and the neonatal calf through passive transfer of antibodies by colostrum. Calves should also have a vaccination that provides protection both passively and actively for respiratory, systemic and enteric disease. Feedlot cattle need to be protected against respiratory and systemic disease at the minimum.

These programs should be worked out in conjunction with your local veterinarian due to their knowledge of your herd and the risks associated in the surrounding area and your management type and style. They also are the most likely to stay abreast of changes in vaccines, medications and will be needed to fill prescriptions and write VFDs for your operations.

Many of the vaccination programs can be confusing, even to a veterinarian! The alphabet soup of IBR, BVD, BRSV, Clostridium C & D or A etc. can be daunting. Various combinations exist of different antigens that must be used in the appropriate manner for stage of production and class of animal. For instance, use of a modified live viral vaccine may cause abortion in an at risk group of cows and heifers.

Preconditioning vaccines and management practices should be a priority in reducing disease and reliance on antibiotics. It is also a welfare issue for me. We know that cattle that are appropriately preconditioned get less disease and perform better. It's like sending our kids to day care and public schools without proper vaccination! Not a good idea. Treatment increases costs, decreases performance and may lead to trim and residue issues. Not the image we want to create in today's world.

Calving management and colostrum

One of the keys to improving cattle health is to have a healthy calf born and get its belly full of colostrum in a timely manner. Assisting early in labor increases the chances of a live calf and dam. If no progress is seen after two hours of active labor, intervention is probably necessary. After birth, the calf should be nursing within two hours, have navel care, identification and whatever practices are needed for that farm. This may include but not be limited to vitamins, selenium, probiotics, antiserums and vaccines. All calves should receive ten percent of the body weight in colostrum within the first twelve hours of life. Very hard to do in beef cattle and complicated even further by the fact that we rarely check the quality of colostrum, which varies greatly from dam to dam.

Early weaning in beef calves

There are many times or management styles that rely on early weaning of beef calves (dairy calves are early weaned all the time!). This is a critical stage for these calves as passive immunity is waning and active immunity is probably not adequate to protect. Vaccination early prior to weaning and then boosters as appropriate may help improve the health and welfare of these calves. Boosters later in the production cycle may also benefit these cattle and even traditionally weaned and vaccinated calves. If early weaning, other management practices may need to be adjusted for these calves.

Other considerations for improving cattle health

Handling of cattle has been a very hot topic for the last several years. Low stress handling will improve animal health and well-being. It will probably improve our health and disposition as well! If you do not know how to handle cattle, learn. If you think you know how to handle cattle, you still need to learn! Having spent most of my life on various farms throughout the country and having taught veterinary students, I can assure you that we have a long way to go in our cattle handling overall. Facilities play into this as well. If you do not have facilities to handle cattle properly, you will be working against the cows and yourself. Take time. Plan. Think.

Cattle genetics also play a role in health. Do we pick flighty cattle? Poor conformation? Screen for genetic diseases? Think about that as you are stripping out that pop bottle teat on a cold Sunday morning trying to get a calf to nurse. Culling is important.

Today we are under more scrutiny than ever before and are dealing with a population that is third and fourth generation removed from agriculture. Think about what you are doing and how that reflects on our industry and the welfare of the animals. Our future depends on it.

Hedging: Using market tools to mitigate your price risk

Carl Babler, principal, Atten Babler Commodities, Galena, IL; Karen Voigts, broker, Atten Babler Commodities, Galena, IL

Marketing Terminology

Basis - The difference of the cash and futures price. Basis can be positive or negative.

Call option- Gives the buyer of the call, the right but not the obligation, to buy the underlying futures contract at a strike price, for a specific period of time on a specific amount of the commodity, for a premium cost. Buying a call is used to re-own on commodity after sold in the cash market. Price insurance against higher prices, it gains in value as the market moves higher. Subtract premium cost of call option from cash sale. It can also be used the hedge against higher input costs (feed, fuel) while buying in the spot market.

Example: August $108 cattle call for $2.00/cwt. August futures are $100.00
Underlying futures contract: August Cattle
Strike Price: $108
Expiration: August 4th 2017
Contract size = 40,000 lbs
Premium Cost: $2.00/cwt

Farmer Grace has four contracts of August cattle; she sells four contracts (120,000 lbs) at $100 futures. Grace knows basis can be on average - $1.00/cwt for cattle that time of year. Grace wants price protection if August cattle futures continue to move higher. She buys two (half of the cattle) August cattle $108 calls for $2.00/cwt. She will have a claim if the market is above $108 at option expiration. After basis and premium, the average net cattle price is: 98 cents. ($100-$1=$99) ($100-$1-$2=$97) If Grace has a claim on the calls she will add to the average price.

Buying a call option or vertical call spread is margin neutral, your maximum risk is the premium paid plus transaction cost.

Put option/Minimum price - Gives the buyer of the put the right but not the obligation, to sell the underlying futures contract at a strike price, for a specific period of time on a specific amount of the commodity, for a premium cost. The put is used for price protection on the un-sold commodity to hedge against lower prices if they were to occur. The put is established at time of placement into the feedlot or backgrounder. A put option is price insurance, or a price floor, against lower prices. Put options gain in value as the market moves lower, offsetting losses in the cash market.

Example: June $96 cattle put for $2.00/cwt. June futures are at $103.75.
Underlying futures contract: June Cattle
Strike Price: $96
Expiration: June 2nd, 2017
Contract size = 40,000 lbs
Premium Cost: $2.00/cwt

Farmer Ben needs a price floor on two contracts of June cattle. He buys $96 puts for $2.00/cwt. His insured price is $94. Ben knows basis can be on average +$2.00/cwt for cattle in June. After basis, he has an insured price of $96. Ben knows his upside is open to higher prices if they occur and he will lose the $2.00/cwt premium if June cattle are above $96 at option expiration. He wants to lose the premium and see higher prices because he knows he will make more money if that happens. However, Ben knows the put is there if the market moves lower and will offset his losses, anything below 96 cents, he will have a profit on the put (claim).

Buying a put option or vertical put spread is margin neutral. Your maximum risk is the premium paid plus the transaction cost. The put option is used to establish a minimum price on commodities that are not sold in the cash market.

Fence strategy (Risk reversal) - Buying a put and selling a call. You are selling the call, collecting premium to help reduce the purchase cost of the put option. This position requires maintenance margin to hold the position, and margin calls will occur if the market moves higher, due to the increasing value of the call from where you sold it at.

Example: August feeder $120/$132 fence. August futures are $123.50/cwt.
Underlying futures contract: August Feeder Cattle
Strike Price: Buy $120 put / Sell $132 call
Expiration: August 31st 2017
Contract size = 50,000 lbs
Premium Cost: $3.00/cwt

Farmer Dave will sell 1000 yearlings in July, or approximately 16 contracts of feeder cattle. He needs price protection from the market moving lower. Dave wants August $120 puts but does not want to pay what they are worth, $6.10/cwt. He decides to sell a $132 call against it and collect $3.10/cwt to help pay for the put. His upfront premium cost is: $3.00/cwt (cost difference of put vs call) Total cost on 16 contracts =$25,280 including transaction cost. After premium cost, his minimum price is $117/cwt, and his maximum price is $129/cwt. He sold the $132 call and collected $3.10/cwt. If the market moves higher, the call will gain in value and he will margin every dollar above $3.10/cwt. However, if August feeders are at $132 or below $132 at option expiration, any margin that Dave sent in goes back into his account as excess cash. Dave also can be charged maintenance margin up to $3375/contract to hold the position; he receives that money back after he sells the feeders in the cash market and exits the hedge position.

Hedger - Producer who uses the futures, cash, and or options market to mitigate their price risk until commodity is sold in the Cash Market

Speculator - An individual who accepts market risk in an attempt to profit from buying and selling futures and/or options contracts by correctly/or incorrectly anticipating future price movements.

Hedging vs trading - Producers who involve themselves in trading (trying to outguess the market) are adding more risk to their operations. For the cattle feeder or the backgrounder who buys cattle in the spot market to finish or grow assumes price risk at the time of purchase. Therefore, a hedge should be put on at the time of purchase. With a cow/calf operation, place your hedges on your calves/feeders seasonally; buy puts in the July/August timeframe.

Tips for beginners

Have a budget on how much you will spend on premium. Listed below are averages we do with our customers.

Feeder Cattle: $3.00-$3.50/cwt: Contract size= 50,000 lbs (59 yearlings at 850 lbs)
- Futures cash settle against their index, normally settles at the end of that contract month

Live Cattle- $2.00-$2.50/cwt: Contract size = 40,000 lbs (30 fats at 1350 lbs)
- Deliverable Contract
- Options expire the first Friday of the contract month
- Futures trade to the end of the contract month

Start hedging; you never know how it works until you execute a position. Overtime, you will learn which strategies work best with your personality.

Keep hedging, one year doesn't tell you anything. Consistency is the key to good marketing. Historically, over 30 years, buying puts vs the open market will be even to a little better; however, the difference lies in when the market moves significantly lower. Many times if a producer stays in the open market, during low price cycles they may not make it to the next up cycle in the market; the bank shuts them down because too much equity was lost. Stop the leverage/ de-leveraging swing, BE CONSISTENT!

Your bank will loan you money for hedging through a Hedge Line of Credit. This serves so you do not have to pull money from your operating note. You pay the hedge line back after each group of cattle is sold.

Control your emotions of fear and greed; focus on the farm's bottom line and profitability. If profitability is there, and your objective margin can be met; (example: $100/head) sell something! You never go broke making money. If profit is not shown, or you don't want to sell, buy puts or fences to protect from lower prices. The market does not care about your cost of production, the market can and will move below breakeven levels. Supply and demand have to balance.

Risk in purchasing options is the premium paid plus transaction. Selling futures/or options leaves you vulnerable to unlimited risk. Atten Babler Commodities LLC uses sources that they believe to be reliable, but they cannot warrant the accuracy of any of the data included in this report. Past performance is not indicative of future results.

Cattle Price Action Alert

1 Dec 2016

Controlling Per Head Cattle feeding losses, are you interested?

The chart below (Source: http://www.ksre.k-state.edu) provides an honest review of finishing steers economics over the past 14 years and the reality of all in costs resulting in losses of $100 per head or more in 16 or the last 24 months. Feedlot operators large and small understand that the risk of feeding losses of $200/head or more is real and that controlling per head losses is required to remain financially sustainable in their feedlot enterprise.

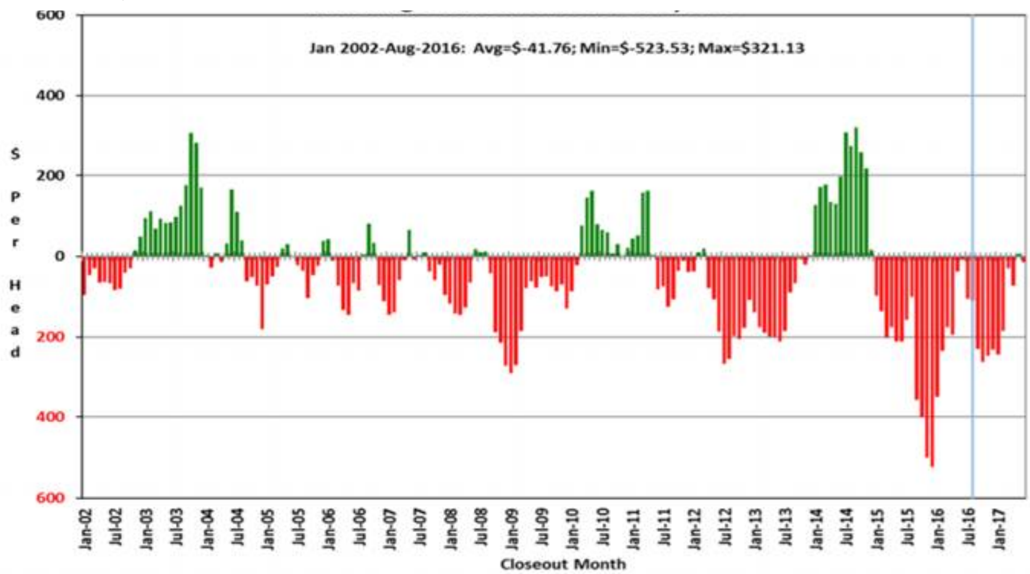

Figure 1. Historical and projected average net returns for finishing steers in Kansas feedyards.

The variations that exist when discussing feedlot characteristics break evens and risk tolerance makes it next to impossible to make blanket hedge recommendations for all cattle feeders. Thus the intent of this Price Action Alert is to look at an example of controlling the per head loss for feedlot operators.

Feedlot assumptions

- Feedlots have assets, passion, comparative advantages and know-how for feeding cattle
- Feedlots seldom at time of placing cattle can lock in an acceptable profit.
- Feedlots have a required risk tolerance of losing $50 to $100 per head as a tradeoff for profit opportunity.
- Feedlots don't like losing money
- Feedlots have various packer contracts and exchange traded futures and options contracts available to manage price risk.

Controlling per head loss – requirements

- Feedlot acknowledges the per head loss risk in forward markets.
- Feedlot decides to manage per head loss risk on all placements
- Feedlot identifies marketing tools that fit their experience and risk tolerance
- Feedlot applies marketing strategy that matches the offered profitability condition
- Feedlot budgets a per head cost for controlling per head loss
- Feedlot consistently applies chosen strategy within budget

Example of per head loss control

- Cattle placed for April 2017 Finish at a weight of 1450 pounds.
- April 17 Live Cattle futures price $110/cwt.
- Per head breakeven $108/cwt.
- Risk; (not examples but actual price risk forward in live cattle futures
  - $98.20 Oct 21,2016 Apr 17 Live Cattle futures contract lows
    - *$142.10 per head loss*
  - $94.30 Live Cattle Weekly futures chart Low 14 Oct 2016
    - *$198.65 per head loss*
  - $78.70 Live Cattle Monthly futures chart low Dec 2009
    - *$424.85 per head loss*
- Option Strategy to Control per head loss
  - Live Cattle Option Contract 40,000 pounds live weight
  - Buy $102 Apr 17 Live Cattle put pay $2/cwt premium $800 per option
    - Each option covers 27 $1450 steers for a premium cost per head $29/hd
  - A $102 price floor with a premium cost of $29/ head would control the loss to a maximum of $116 per head

It is our hope the above math is clear. The example, per head loss risk of $142 to $424 for Cattle Placed for April 17 can be controlled to $116 per head loss with a simple out of the money live cattle put option strategy. This type of strategy is being used by feedlots among our customer base as they control their per head loss while leaving the opportunity for profitable outcomes wide-open. A feeder may relate to the following " a $25-$30 per head cost will not change my life as a cattle feeder but losses of $150 to $400 per head will."

Bottom-line

Producers write per head checks for yardage, vaccination, transportation and other expenses, as a cost of feeding cattle. Likewise producers must include marketing as a cost of being in the cattle feeding business and write a check for per head loss control when placing the cattle. In the end it is not about the math example or a put option it is about a cattle feeder's **decision to take action to be in control of per head loss risk**. With the current Live Cattle futures price rally that has taken place since October we encourage all cattle feeders who have cattle on feed now or who will be placing cattle, to contact our office to discuss controlling per head cattle feeding losses going forward.

Risk in purchasing options is the premium paid plus transaction. Selling futures/or options leaves you vulnerable to unlimited risk. Atten Babler Commodities LLC uses sources that they believe to be reliable, but they cannot warrant the accuracy of any of the data included in this report. Past performance is not indicative of future results.

Bridging the gap between farmers and consumers

Michelle Miller, founder, http://www.thefarmbabe.com, farmer, public speaker, and agricultural columnist at AGDAILY

Michelle grew up involved in 4-H, horse riding and doing chores on her friends' grandparents farms in Wisconsin, but when her high school aptitude tests told her to go into farming, she ignored them and headed west for college and a career in fashion. After working for Gucci On Rodeo Drive in Beverly Hills and spending a number of years in downtown Chicago, she bought into organic, grass-fed, "Monsanto is the devil" food idealism. At this point she caught the travel bug and moved to Florida, where she was able to have a flexible schedule as a 'globetrotting bartender' to finish up her goal of visiting all 7 continents, (57 countries.) she then met her "Prince Farming." In the years she has been living and working on his Iowa farm, she has learned the truths of modern agriculture firsthand and enjoys educating the public and debunking the popular myths she once believed in. Together, she works alongside him and his family on nearly 2,000 acres of corn, soybeans, alfalfa, oats, sheep, and cattle. She's happier than she's ever been to get back to her "roots" of being involved with animals and farming and has gone from being skeptical about food to to sharing her passion of modern agriculture! She's literally gone from Rodeo to the Rodeo, and wouldn't have it any other way.

Throughout her speaking engagements, she shares her story and encourages farmers to tell theirs. Michelle believes many consumers are confused and misinformed based on marketing tactics and it's our job to speak out about our careers as farmers to bridge the gap between consumers and food producers with the real truth. Through her educational and fun, enlightening social media platforms as the Farm Babe, she has reached millions of people and has nearly 50,000 followers.

She can be found on:

- **Facebook**: https://www.facebook.com/IowaFarmBabe/
- **Twitter**: https://twitter.com/thefarmbabe
- **Instagram**: https://www.instagram.com/thefarmbabe/
- **SnapChat**: @thefarmbabe
- **Website**: http://www.thefarmbabe.com

Maximizing margins for cow-calf producers through improved limit-fed hay procedures

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Introduction

With feeder cattle prices in early 2017 hovering at approximately half of the high-water mark noted in 2014, it is safe to say that producers are once again looking for ways to improve margins. Unfortunately, as producers cannot control the markets, one must revert to controlling input costs without sacrificing production; a concept that escaped many producers during the lucrative years of 2013-2015. The concept of controlling input costs may sound simple, but even in a time where much of the country has access to relatively cost-effective feedstuffs, LMIC has 2017 annual cow costs projected in excess of $800; more than 45% higher than in 2010 before droughts began impacting much of the U.S.

In the Midwest, feed routinely represents in excess of 60% of total costs to the cow-calf enterprise. Of that, wintering feed costs, primarily in the form of harvested forages, are often the largest cost to the operation. Thus, it is logical that winter feeds would be the first input to scrutinize when controlling costs. Particularly in a year when some meteorologists are predicting a drought for the Midwest and Eastern Cornbelt, looking at ways to minimize feeding waste and perhaps even limit intake of forages could be essential to maintaining margins.

The need to control storage and feeding losses

Harvested forage losses occur through two primary avenues; storage losses and feeding waste/refusal. Research conducted by the University of Tennessee (Lane, 2009; Table 1) and University of Nebraska (Neimeyer, 2014; Table 2) highlight the enormous variance in losses and weathering associated with different storage strategies. Also as highlighted in Table 2, storage method has a significant effect on amount of weathered forage that is likely to be wasted at the bunk or feeder. It should not be overlooked that in addition to these losses, feeder type also plays a role in the amount of waste that occurs when cows are given unlimited access to baled forages (Buskirk et al., 2013; Table 3). When combined, storage and feeding waste of a typical operation in the Midwest is often in excess of 35%. Assuming an average Midwestern beef cow-calf operation of 40 head, and a hay cost of $80/ton, this equates to more than $100 per cow, which can make-or-break an operation in the current beef economy.

Opportunities to reduce losses

There are a myriad of opportunities to reduce both storage and feeding losses. At the storage level, storing hay inside, or placing forages in silage wrap (either wet or dry forage) can reduce storage and handling losses to as little as 5%. An argument can be made that producers pay for a hay shed either through construction of the building or through storage losses; however, the up-front-cost of a building can be cost prohibitive to smaller scale operations.

Baleage is another production opportunity that reduces both storage losses and waste at the feeder and can have significant economic and feeding benefits for producers (Gunn and Sellers, 2016). Yet again, smaller operations that are dependent on custom operators for baleage production may not be able to optimize this process. Furthermore, enterprises with smaller horsepower tractors may not be able to handle the added weight that ensiled bales of hay present.

In terms of limiting feeding waste, feeding a total mixed ration (TMR) perhaps presents the best opportunity to maximize consumption. Grinding of the forage allows producers to essentially blend off weathered parts of the bale that would normally be selected against by the cow. When combined with other palatable feedstuffs, a carefully formulated ration can result in negligible waste at the bunk. However, a TMR approach is often considered an economy of scale. Effective utilization often requires significant investment in equipment and infrastructure as well as a shift in management so that feed is delivered daily. However, such procedures may not fit into the managerial preferences and abilities of the average size Midwestern operation.

Limit feeding also presents the opportunity to reduce feed waste. Furthermore, in the event of a drought, where forages become costly and concentrates may be a more cost effective feedstuff per unit of protein or energy, limit feeding also presents the opportunity to control input costs and stretch forage supplies without the added infrastructure needed for a TMR delivery system. While limit feeding can occur through a few different avenues including unrolling hay or restricting access to the feeder, it is safe to say that placing feed on the ground will often result in more waste than desired or anticipated in many instances.

Researchers at Purdue University have evaluated limit feeding dry hay to cows in bale feeders. In a fairly simplistic design (Figure 1), an electric fence was placed around the bale feeder on the feeding pad, but allowed cows 24-hour access to water and supplement (as-needed). On a side note, this process doubles as a best management practice during calving season, as many producers can better implement a night-time feeding routine to promote daytime calving (Rasby, 2014). In a series of studies at Purdue, intake of varying qualities of forage over varying access times to the forage was evaluated. Results from the studies indicate that a cows can consume all of the dry forage she is capable of consuming over a 24-hour period in as little as 6 hours per day. Not surprisingly, as cows have increased access to forage beyond 6 hours, the amount of hay that disappeared form the feeder increased, many times due to sorting and waste. Through the combination of trials, a regression equation was developed that allows producers to estimate intake of a particular forage based on the neutral detergent fiber (NDF) content of the forage and the hours of access granted to the feeder:

$$\text{Intake as a percent of empty cow body weight} = (0.30 * \text{Hours of access}) - (0.02 * \text{Hay NDF \%}) + 1.34$$

For example, if a 60% NDF hay was allowed to be access 5 hours per day:

$$(0.30 * 5) - (0.02 * 60) + 1.34 = 1.64\% \text{ of body weight}$$

Assuming the cow is 1350 pounds at a body condition score of 5:

$$1350 * 0.0164 \text{ (intake \% converted to a decimal)} = 22.14 \text{ pound of dry matter intake per day}$$

This then needs to be converted to an as-fed basis to account for moisture in the forage. Assuming an 85% hay dry matter:

$$22.14/0.85 \text{ (dry matter \% converted to a decimal)} = 26.04 \text{ pounds of hay per day, as delivered.}$$

In the event that a forage budget has been conducted and it has been determined that resources are limited, this equation can also be rearranged to determine the amount of access time that can be granted so that forage resources do not run out.

While this limit feeding design provides even the smallest of producers the opportunity to limit feed hay with minimal infrastructure upgrades, it is prudent that producers keeps these three keys in mind: 1) This intake may or may not meet the energy and crude protein demands of a cow at a given stage of production. Therefore, producers should work with their extension professionals or nutritionist to develop an appropriate supplementation scheme around this limit feeding process; 2) To optimize this management scheme and ensure nutrient demands of the cow are met, an nutrient analysis of the forage must be conducted; 3) This technique will not effectively offset storage processes that result in damaged, weathered, and/or rotten forage. The damaged fraction of the bale will not be well consumed unless placed in a TMR as previously described. Forcing cows to consume this portion of the bale will almost always result in decreased performance.

Finally, it should be stressed that limit feeding regimes should be sure that cattle have plenty of bunk or feeder space. In many instances this means 24-30" of bunk space and often times 2 spaces on a bale feeder per cow. Other considerations include: 1) making sure fences are good quality; 2) grouping cattle to minimize dominant/subordinate relationships; and 3) considering force-feeding mineral in a supplement to avoid over consumption of mineral in a free choice environment.

Conclusion

There are multiple ways to control feed costs, storage loss and waste; some of which are more cost-effective to small and medium-sized producers than others. It should be emphasized, that at the end of the day producers still sell output, and there is a law of diminishing returns when cutting input costs. Therefore, be mindful of changes in management that may negatively impact gross income to a greater extent than it positively impacts input cost.

Table 1. Losses of round baled hay stored using six methods of storage[1]

Treatment	Storage loss, %
On ground, twine tied, no cover	37
On tires, twine tied, no cover	29
On ground, twine tied, covered	29
On tires, twine tied, covered	8
Net wrap, on ground	19
In barn	6

[1]Stored from June to January.

Table 2. Visual damage of round bale losses after one year of storage[1]

Treatment	Storage loss, %
Uncovered, twine tied	17
Uncovered, net wrapped	17
Tarp covered, twine tied	6
Tarp covered, net wrapped	5

[1]Bales stacked in a two-high pyramid.

Table 3. Effect of feeder type on hay dry hay feeding waste feeding[1,2]

Treatment	Feeding waste
Ring	17
Cone	17
Cradle	6
Trailer	5

[1]Adapted from Buskirk et al., 2003.

[2]Hay was stored inside to reduce weather forage refusal, and hay to feeder diameter ratio was reduced to force cows to reach further.

Figure 1. Simple limit feeding of forage design using electric fence around a feeding pad.

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Nutrient requirements of heavy finishing cattle

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Introduction

Improvements in genetics, nutritional strategies, and management, combined with the use of growth promoting agents have resulted in a long-term trend for increased carcass weights. Annual average carcass weights for steers, on a dressed basis, were 25% higher in 2014 compared to 1974 (USDA, 2015). Thus, it is not surprising that heavier carcass weights were recorded in 2014 than in 2013; however, the magnitude of this increase is greater than what was predicted by the long term trend. Predicted average carcass weight for steers in 2014 was 858 lb while recorded average carcass weight was 872 lb. This increase is especially notable in light of the removal of Zilmax (Zilpaterol HCL), the most potent β-agonist, from the market in August 2013. Carcass weights continued to increase for much of 2015 although more recently weights have moderated. Regardless, cattle feeders in the Upper Midwest have traditionally finished cattle at heavier weights, as such this topic will remain of importance for in this region of the country for the foreseeable future.

Although there has been a long term trend toward finishing cattle at heavier weights, we continue to formulate diets based on nutrient requirements derived from lighter cattle and extrapolated out to heavier weights. A meta-analysis was completed to determine if the Nutrient Requirements of Beef Cattle (NRC, 2000), nutritionists primary reference for diet formulation (Vasconcelos and Galyean, 2007), adequately predicted energy and protein requirements for modern, heavy finishing cattle.

Methods

A dataset derived from 19 studies containing 289 means for treatments testing beta-agonists during the final 14 to 42 days of finishing was subjected to a meta-analysis to determine if the NRC, 2000 adequately predicted energy and protein requirements for heavy finishing cattle. Performance characteristics were modeled to ensure that data represented a normal population of cattle (Figures 1 – 4). The data presented throughout this manuscript represent only the treatment means of steers, 216 treatment means. Analysis of heifer requirements was omitted due to insufficient animal numbers to generate meaningful conclusions. Table 1 details weighted steer feedlot performance means used in the analysis.

The basic premises of the California Net Energy System dictate that if the energy concentration and dry matter intake (DMI) of a diet is known then performance can be predicted. The opposite is also true, if performance and DMI are known then energy concentration can be predicted. When this premise does not hold true it suggests that a portion of the system is compromised and it is our contention that the most likely culprit is due to shifts in the nutrient requirements of cattle at heavy out weights. A simplistic method of evaluating the necessity of derivation of new requirement equations is to plot the expected versus observed performance, based on net energy of gain (NEg) intake (Figure 5). If prediction equations fit the data perfectly we would expect the ratio of observed to expected performance for each treatment to be one. The variability of this ratio suggests that further exploration into the adequacy of the NRC equations is indeed warranted.

Reported DMI and energy concentration of diets were used to partition DMI into feed required for maintenance, which allows for feed available for gain to be determined by difference. A ratio of observed to expected DMI was used to determine a correction multiplier to account for the variability in DMI attributed to differences in management and environment across experiments (Zinn et al., 2008). Net energy of maintenance (NE_m) was calculated at 77 kcal per kg body weight$^{0.75}$ (Lofgreen and Garrett, 1968). Feed available for gain and NE_g were used to calculate retained energy (RE) and a regression approach was used to generate new NE_g equations. The best-fit was determined using an F-test with a value of $P < 0.05$.

Protein accretion was calculated based on animal performance using the method described by Owens et al., 1995. Metabolizable protein intake (MPI) requirement was determined by empty body protein gain (g/kg $BW^{0.75}$) regressed on MPI (g/kg $BW^{0.75}$). The best-fit was determined using an F-test with a value of $P < 0.05$.

Energy requirements

Unsurprisingly, the model which best-fit the data consisted of separate equations for cattle that were not fed a beta-agonist and cattle that were fed a beta-agonist. A comparison of requirements at various weight classes and rates of gain are shown for cattle not fed a beta-agonist in Table 2 and cattle fed a beta-agonist in Table 3.

In cattle that were not fed a beta agonist, the directional change of the calculated requirement as compared to NRC(2000) requirement was dependent on rate of gain. At lower rates of gain cattle were more efficient than predicted by the

NRC(2000); however, at greater rates of gain cattle were less efficient than predicted by the NRC(2000). For example, a steer finished at 1600 lb would be 3.8 % more efficient at utilization of dietary NE_g than predicted by the NRC(2000) at an ADG of 2.5 lb; however, the same steer would be 1.7% less efficient than predicted by the NRC(2000) at an ADG of 4.0 lb. The breakpoint where cattle transitioned from being more efficient to less efficient fell at a higher rate of gain in cattle finished at lighter weights, such that a steer finished at 1350 lb would retain greater efficiency, as compared to the NRC(2000) prediction, at heavier rates of gain as compared to a steer finished at 1600 lb. At 3.0 lb gain per day, a steer finished at 1350 lb would be 1.1% more efficient at utilization of dietary NE_g while a steer with the same rate of gain finished at 1600 lb would only be 0.4 % more efficient than expected. This example assumes both steers are consuming the same amount DMI and are gaining the same amount of weight across at set number of days on feed. Differences in predicted versus observed requirements across varying out weights supports the assertion that biological efficiency decreases at heavier weights due to the shifts in composition of gain as cattle progress through the growth curve, with heavier, more mature cattle, accreting a greater proportion of total weight gain as fat (Owens et al., 1995).

In contrast, while the energy requirement of steers fed a beta-agonist was not accurately predicted by the NRC(2000) the nature of this relationship differs from that of steers not fed a beta-agonist such that NE_g requirements decreased across all weight classes and rates of gain in a consistent manner. This observation is consistent with previous studies that have shown increased ADG without increasing DMI (Bohrer et al., 2014) which is attributed to a repartitioning of energy toward lean tissue accretion (Mersmann, 1998).

Changing energy concentration in the diet during the end of finishing is unlikely; however, this information could be used to refine predictions of target endpoints.

Protein requirements

Similar to energy, the MPI requirement was most accurately modeled utilizing two equations; however, the nature of the equations differed from the energy equations. In both cattle fed with or without a beta-agonist cattle were more efficient at lower rates of gains than predicted by the NRC(2000); however, at greater rates of gain cattle were less efficient than predicted by the NRC(2000). The breakpoint in the shift in efficiency, as compared to the NRC(2000) falls at a lower rate of gain in lighter weight cattle, which is likely explained by differences in body composition.

Cattle fed a beta-agonist retain greater efficiency in MPI utilization at greater rates of gain, which is likely a function of the increased overall efficiency associated with use of a beta-agonist. However, this data suggests that MPI is being under-supplied at higher rates of gain in beta-agonist fed cattle.

Conclusions

This analysis of energy and protein requirements suggests that current equations do not accurately predict performance of cattle during the end of finishing. Efficiency of nutrient use, energy and protein, was found to be greater than predicted at lower ADG but poorer than predicted at greater ADG. While changes in energy provision to cattle are unlikely, this information could be used to further refine expectations of performance during the final phase of finishing which can be helpful in targeting specific weight endpoints. This data suggests that MPI is being under-supplied during the final phase of finishing.

Determining nutrient requirements for heavy cattle is an important component to maintaining maximum efficiency and supporting profitability; however, other considerations such as managing to minimize cattle lameness at heavier weights as well as ensuring that facilities are capable of accommodating heavier cattle (working facilities, pit capacity, water fountain capacity) should also be an emphasis.

Tables and figures

Table 1. Weighted means of steer feedlot performance.

	No beta agonist			Beta agonist		
	Average	S. D.	Range	Average	S.D.	Range
Treatment means	78			138		
Animals	15,528			27,857		
Shrunk initial BW, lb	1173	206	934 -1329	1177	211	924-1334
Shrunk final BW, lb	1274	223	1052-1472	1293	223	1074-1500
ADG, lb	3.12	1.94	1.52-4.62	3.57	1.90	1.75-5.72
DMI, lb	22.4	10.0	15.1-31.2	22.1	8.5	14.7-32
FTG	7.6	3.8	5.3-13.4	6.4	2.4	4.0-8.9
Days on feed	32.3	14	42	32.3	14	42

Table 2. Comparison of NRC (2000) and calculated energy and metabolizable intake protein requirements of steers.

	Initial BW (lb)	Final BW (lb)	ADG (lb)	Day on feed	DMI (lb)	NRC NEg (mcal/lb)	New NEG (mcal/lb)	NRC MPI (g)	New MPI (g)
Steer	1200	1400	2.5	80	25	46	44	682	517
Steer	1200	1400	3.0	67	25	52	50	723	729
Steer	1200	1400	3.5	57	25	58	57	763	729
Steer	1200	1400	4.0	50	25	64	64	801	1267
Steer	1300	1500	2.5	80	25	47	45	706	507
Steer	1300	1500	3.0	67	25	53	52	747	718
Steer	1300	1500	3.5	57	25	59	59	786	968
Steer	1300	1500	4.0	50	25	65	66	824	1257
Steer	1400	1600	2.5	80	25	49	47	730	497
Steer	1400	1600	3.0	67	25	55	54	770	708
Steer	1400	1600	3.5	57	25	61	61	809	958
Steer	1400	1600	4.0	50	25	67	68	847	1247

Table 3. Comparison of NRC (2000) and calculated energy and metabolizable intake protein requirements of steers fed a beta agonist.

	Initial BW (lb)	Final BW (lb)	ADG (lb)	Day on feed	DMI (lb)	NRC NEg (mcal/lb)	New NEG (mcal/lb)	NRC MPI (g)	New MPI (g)
Steer, beta agonist	1348	1400	2.5	28	25	48	44	686	390
Steer, beta agonist	1337	1400	3.0	28	25	54	50	724	552
Steer, beta agonist	1327	1400	3.5	28	25	60	56	760	744
Steer, beta agonist	1316	1400	4.0	28	25	66	63	796	965
Steer, beta agonist	1448	1500	2.5	28	25	50	46	711	382
Steer, beta agonist	1437	1500	3.0	28	25	46	52	748	545
Steer, beta agonist	1427	1500	3.5	28	25	62	58	784	736
Steer, beta agonist	1416	1500	4.0	28	25	68	64	820	957
Steer, beta agonist	1548	1600	2.5	28	25	51	47	735	375
Steer, beta agonist	1537	1600	3.0	28	25	57	53	772	537
Steer, beta agonist	1527	1600	3.5	28	25	63	59	808	729
Steer, beta agonist	1516	1600	4.0	28	25	69	66	844	950

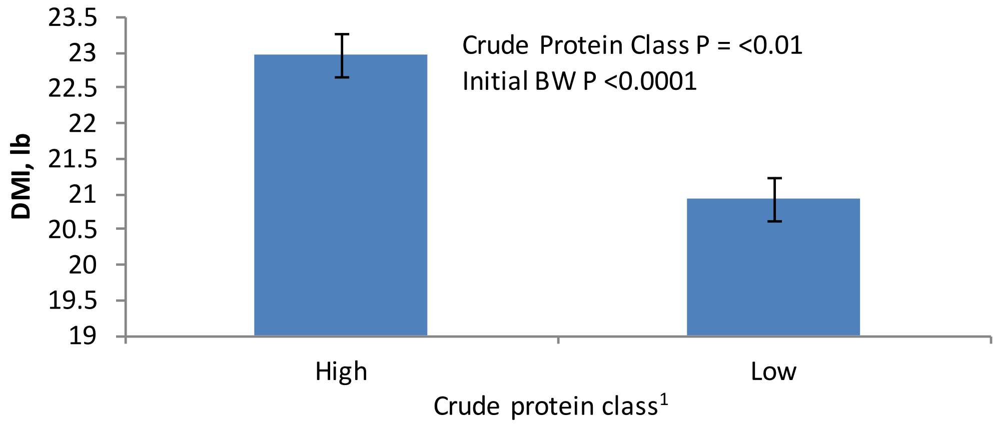

Figure 1. Variables with significant impact on dry matter intake. [1]Crude protein class classified as > or < 13.5%

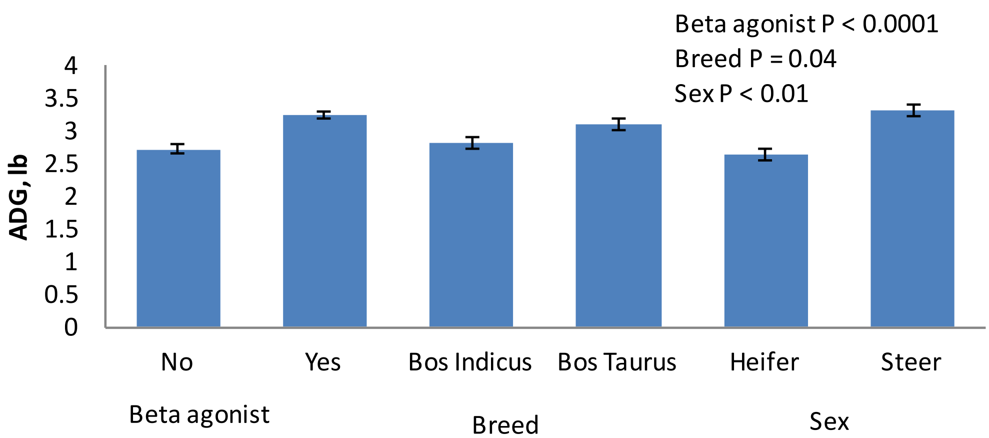

Figure 2. Variables with significant impact on average daily gain.

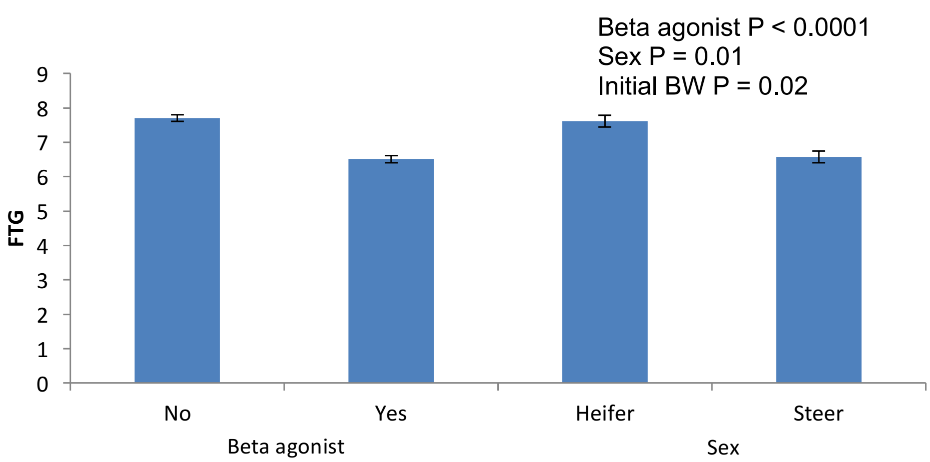

Figure 3. Variables with significant impact on gain effiency. Data analyzed as gain:feed for significance, presented as feed:gain.

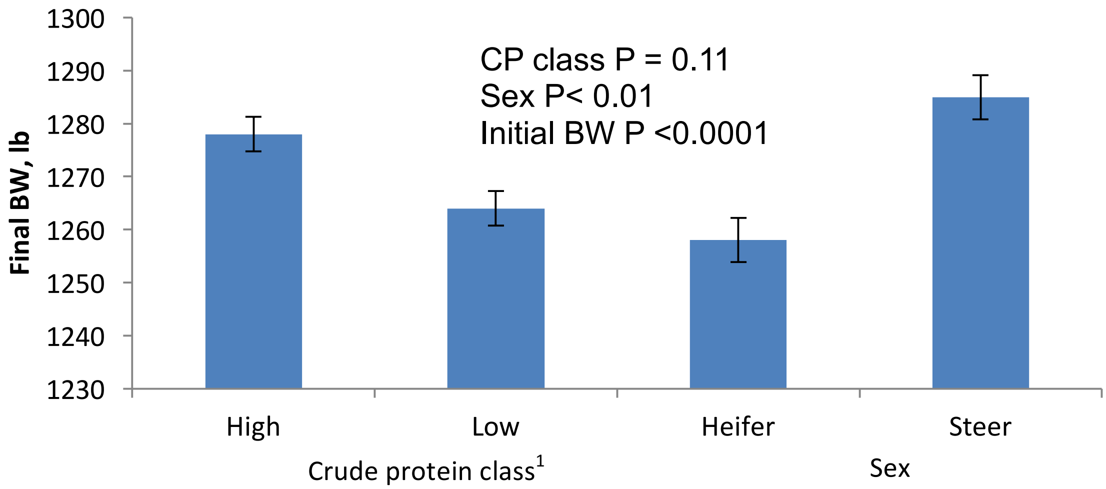

Figure 4. Variables with significant impact on final body weight. Crude protein class classified as > or < 13.5%

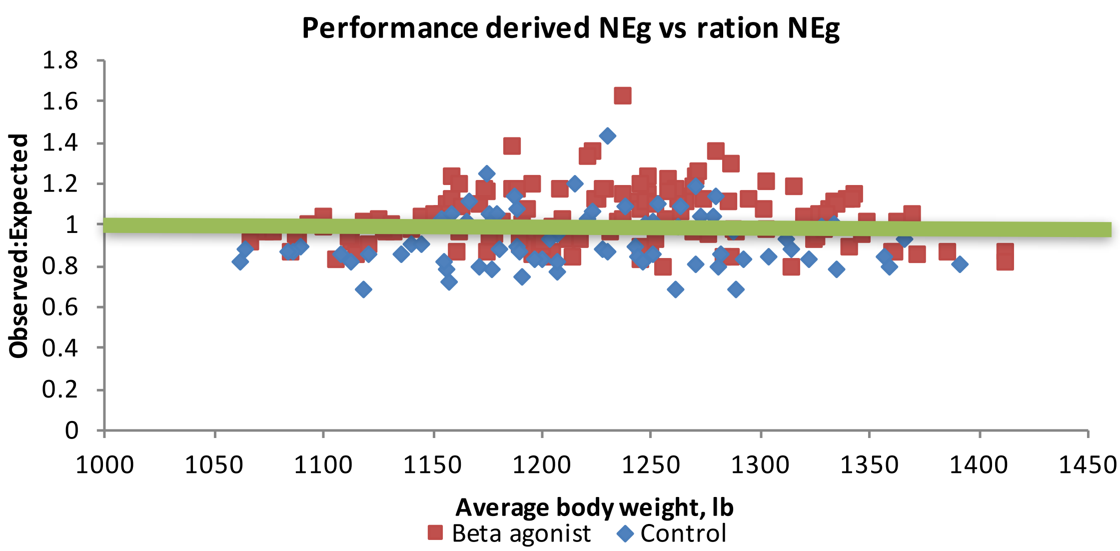

Figure 5. Ratio of performance derived NE_g to ration derived NE_g

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Supplementing cows grazing lush, Spring forages

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Introduction

During the winter season most cattle are supplemented with dry forages, grains, and co-products. This ration is balanced and delivered to cattle. Then spring comes along and cattle are put out to grass. While green grass solves a lot of problems associated with winter feeding (manure, pen maintenance, calf health, and labor demands), it can pose nutritional challenges. Lush, spring forage has three major challenges when it comes to meeting cattle nutrition requirements.

Challenges and solutions

The first challenge is dry matter. Wet, washy grass can frequently be below 25% dry matter. This makes it hard for the cow to consume the enough dry matter (DM) to meet energy demands. During the rapid, spring growth most forage samples will be below 20% DM. This requires a lactating 1400lb. cow with average milk to consume 138 lbs. of fresh grass to meet her energy requirement. If that cow is a higher milking cow, she would need to eat 158 lbs. of fresh grass. In most cases, the cow fills up her rumen between 100 and 125 pounds. Physical fill can be a limiter on performance when grazing washy grass.

The second challenge is high protein content of lush forages coupled with moderate energy content. Excess protein can be a problem when energy supply is short. When rumen microbes are presented a diet that is excess in protein and deficient in energy (low in carbs, fats, and sugars), deamination of protein occurs. This process results in production of ammonia and a carbon skeleton that can enter the Krebs cycle for energy production. Ammonia produced from this process crosses into the blood via the rumen epithelium. Ammonia is then converted to Urea by the liver and excreted in the urine. Excess protein has been well documented by the dairy industry as a detriment to reproductive performance. Some researchers argue excess protein is not a problem. I would suggest that producers must have adequate or above adequate energy in the ration before excess protein is ok. Even then, I would prefer the excess protein contain a good portion of rumen undegradable protein.

I have observed cattle panting after being on lush, green grass for a few days. The panting was not due to heat stress either, the temperature was in the high 60's. These cattle were panting because they needed more oxygen. Red blood cells carry oxygen to the cells. They must also carry ammonia away from the cells to the liver. I feel the panting I observed was due to too much ammonia in the system. I challenge you to watch your cattle on lush, green grass.

The third challenge is fiber. The low fiber content of immature forages results in very high passage rates and an unsatisfied cow. It seems odd that cows would be unsatisfied while knee-deep in green grass. However, I have observed this several times. Cows will readily consume a low level of dry grass hay with lush pasture. This can help the DM problem and add fiber.

While there are numerous solutions to remedy this short term problem, the main goal needs to be supplying cattle with a balanced ration. Unfortunately, lush pasture is not balanced. Some strategies may include delaying turnout until grass matures a bit more, supplying palatable dry baled forage that is low or moderate in protein (not alfalfa hay), supplementing with grains (not over 0.5% of body weight), or grazing only the top 1/3rd of the grass plant.

Research

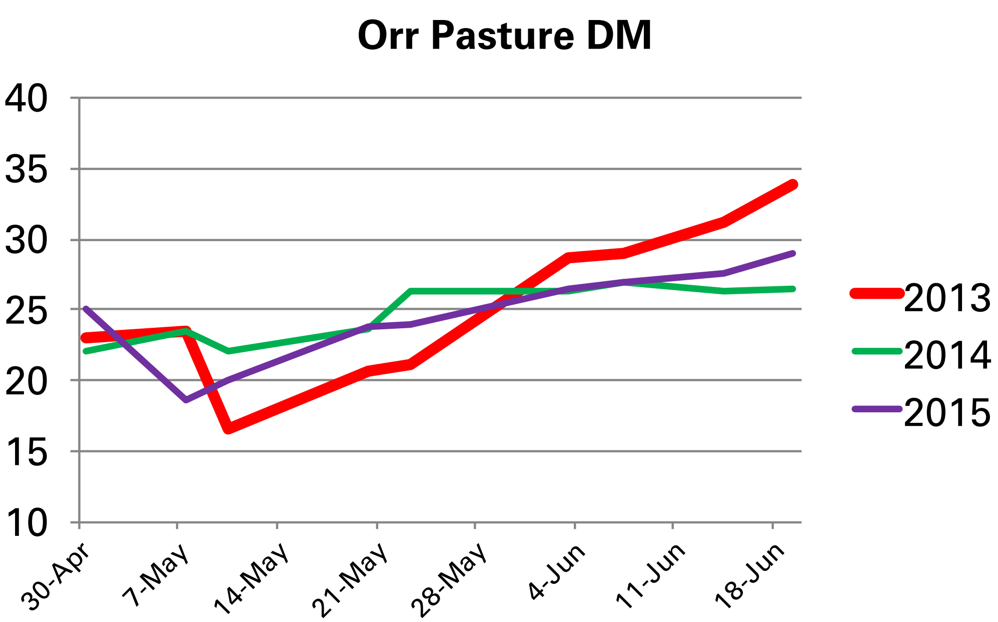
This project utilized 120 Angus and Simmental-Angus lactating cows. Cows had calves at side during the study. There were approximately 60 cows per treatment with 3 reps of 20 head per treatment. The study was conducted in 2013 and 2014.

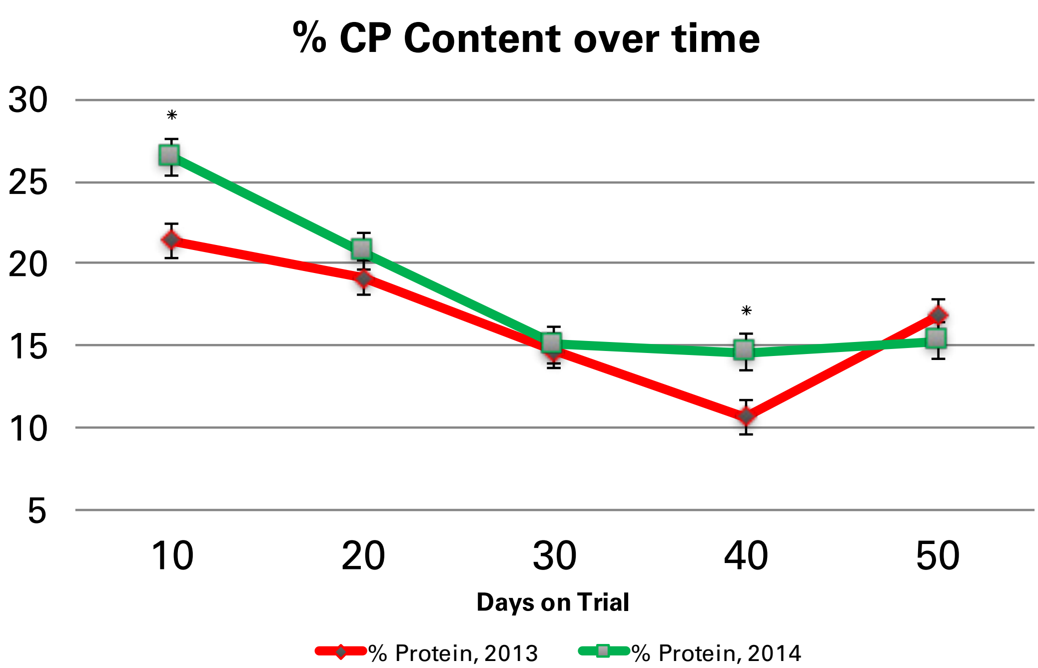
The two treatments were supplemented cows (SUP) and a non-supplemented control (CON). The SUP cows received a supplement mix of 45% soybean hulls, 45% ground corn cobs, and 10% dry molasses (as-is basis). The supplement was fiven at a rate of 4 lbs. per head per day. Each SUP group received 80 pounds of supplement per day. Cows were rotationally grazed on fescue-clover mixed pastures. The CON cows received no supplement and were rotationally grazed on fescue-clover mixed pastures. A Co-Synch Cidr protocal was used and cows were time-AI'd. Cows were turned out to pasture the day of CIDR insertion, or approximately 10 days prior to breeding.

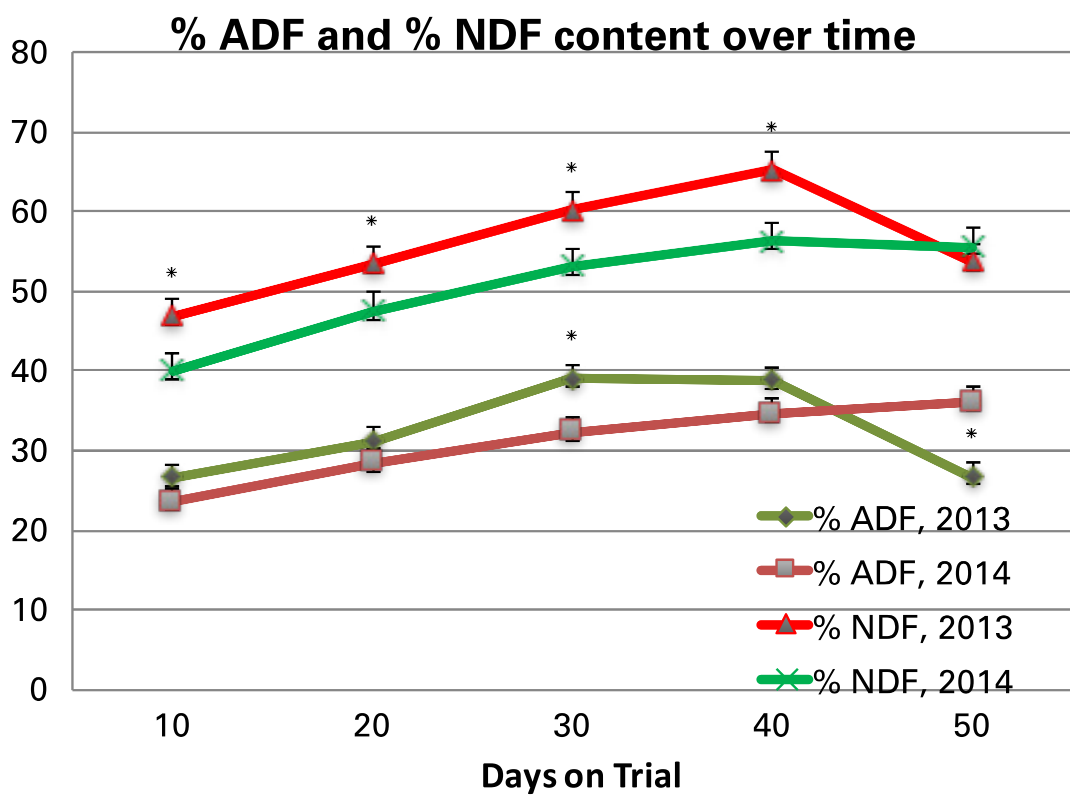
Pastures are mixed red clover, white clover, and endophyte-infected fescue. Pastures ranged from 8 to 14 acres in size. Each allotment was rotationally grazed, moving between 2 pastures as necessary to ensure sufficient forage availability. Stand density was measured daily, and when a pasture was determined to be too sparse to support continued grazing, the allotment was moved to its other pasture. After cows were moved off a pasture, it was clipped to remove seed heads and maintain a vegetative state so forage would continue actively growing to recover before cattle were returned to it.

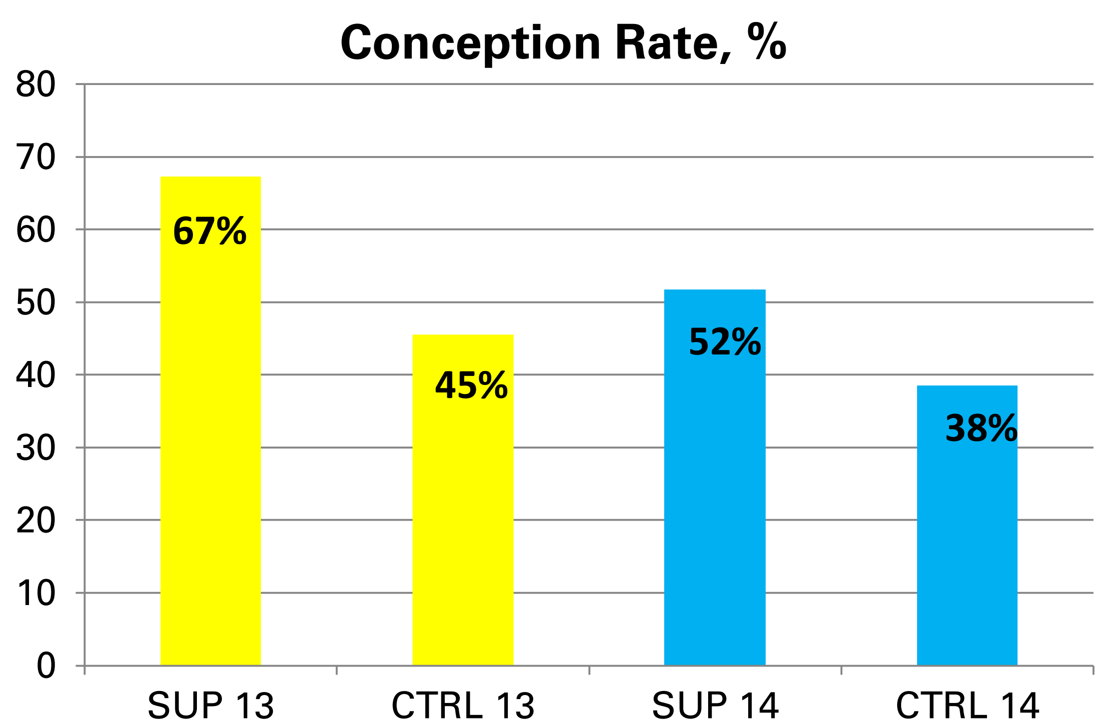
In 2014, blood samples were collected on day 0, 7, 10, and 18 of the trial. Samples were analyzed for non-esterified fatty acids (NEFA), beta-hydroxybutyrate (BHBA), and blood urea nitrogen (BUN). In both years forage samples were taken and analyzed for CP, ADF, NDF, and ash. Composited forage samples were analyzed for forage nutrients such as CP, ADF, NDF, and ether extract.

Results showed no difference in cow body weight change or cow body condition score when comparing day 0 to day 70. No differences were seen in NEFA or BHBA concentrations. Slightly elevated BUN levels after one week on pasture were observed for the CON group. The BUN results may indicate an imbalance in forage protein to forage energy. This high ratio may still have subtle and short, brief negative impacts on energy state of the cows. Conception rates to A.I. were not statistically different, but numerically an advantage was observed for the SUP cows in both years of the study.






% ADF and % NDF content over time
80
70
60
50
40
30
20
10
0
10
20
30
40
50
Days on Trial
% ADF, 2013
% ADF, 2014
% NDF, 2013
% NDF, 2014


Conception Rate, %
80
70
60
50
40
30
20
10
0
67%
45%
52%
38%
SUP 13
CTRL 13
SUP 14
CTRL 14

BQA feedyard self-assessment and upcoming industry opportunities

Doug Bear, Director of Industry Relations, Iowa Beef Industry Council

Introduction

The beef industry must continuously adapt to requested demands by our ever-evolving consumers. But are you prepared and ready? Did you know that the average consumer is now over three generations removed from the daily production practices that occur on your farm? One of the most valuable messages that the beef industry can share with consumers include the "3 C's" – we care, we are capable, and we are continuously improving in our journey to produce safe, wholesome beef. The industry has a prime opportunity to engage with consumers by sharing our beef story. An important piece of the beef story is the industry's gold standard BQA Program. One of these checkoff-funded resources is the BQA Feedyard Assessment. There are a number of current assessments/audits/site-verifications (Tyson FarmCheck™, Progressive Beef, Cargill in 2018, etc.) within the beef industry, but if a producer can implement the BQA Feedyard Assessment into their operation – the BQA Feedyard Assessment can serve as the foundation for the others.

BQA feedyard assessment

The BQA Feedyard Assessment is an on-site educational tool that allows for assessing and benchmarking key indicators of animal care and well-being as well as feedyard conditions. The Feedyard Assessment focuses on three main areas – Animals, Records and Best Management Practices (BMP), and Facilities and Equipment.

The BQA Feedyard Assessment may be utilized as a self-assessment or conducted by a third-party assessor. The real key, regardless of who conducts the assessment, is that the assessment be repeated on a periodic basis so that comparisons may be made, trends observed, and management actions be taken to maximize animal care and well-being and feedyard efficiency.

The BQA Feedyard Assessment consists of multiple assessment points grouped into nine main categories. The assessment is about continuous improvement and provides an in-depth playbook to prepare producers for current and upcoming assessments, audits, or point-of-sale programs for verification of marketing beef. The assessment can help identify items and create benchmark points that may need to be improved. These items may include animal handling, facility/equipment maintenance, and recordkeeping/BMPs among other items. Repeating the assessment on a regular basis will help a feedyard identify trends and take appropriate management actions.

The content of the BQA Feedyard Assessment guide includes all assessment categories and points as well as a short explanation of how to complete the measure for category points. The complete assessment forms have a common framework, they list the following:

- *Major category* (ex: BMPs/Records)
- *Category Point*, a specific component of a major category, (ex: Training)
- *Measure*, how the category point is evaluated (ex: Is there a protocol in place?)
- *Result*, (4 choices, select one of the following)
    - Acceptable/Yes – This point/measure was satisfied appropriately
    - Requires action – This point/measure was somewhat satisfied but could use improvement, requires the comment field to be filled out
    - Unacceptable/No – This point/measure was not met satisfactorily, requires comment field to be filled out
    - Not Applicable – This point does not apply in this operation/situation, comment section may be completed to explain why
- Comments, area for comments on that category point including commentary on why a measure was recorded as it was and advice for improving that point in the future (Optional for "Acceptable" result).

Scheduling

If a third-party assessment is to be conducted, adequate notice should be provided so that biosecurity protocols are known and can be observed by an off-site assessor. Additionally, advance notice will provide time for copies of any required records that may be stored off-site to be made available at the feedyard site.

When should operations be assessed?

An assessment should only be conducted when the site is operating under normal conditions. For example, do not perform an assessment during a period of disease-outbreak or when another serious factor or factors may be impacting the operation creating "abnormal" conditions whereas the feedyard is not exhibiting "normal" operational conditions (ex: extreme weather conditions, natural disaster, etc.). Additionally, an assessment should not be conducted if doing so would force animals to be handled or moved during conditions which may be detrimental to animal well-being.

Forms

The assessment forms have been designed in an assessment-flow pattern to help eliminate backtracking and/or moving inside/outside/inside, etc. However, these forms cannot account for all situations and the assessment-order is only a suggested order, the assessment may be completed in any order as deemed appropriate by the assessor.

Emergency action plan

In case of an emergency it is important for communication to occur quickly and efficiently. The operation should have a written emergency action plan (EAP) that can be implemented for a variety of situations. The EAP should be posted at various locations throughout the operation and include, at a minimum, telephone numbers of the owner, veterinarian, equipment suppliers and fire and police departments.

Choosing pens/animals to assess

Efforts should be made to randomly select pens, water troughs, feed bunks and cattle for the assessment. This could include use of the feedyard's "yard sheet" or drawing numbers from a hat or box to identify pens that will be subject to the assessment prior to driving/walking around the feedyard. The yard sheet will also help ensure that pens being assessed are currently occupied with cattle. A minimum of ten pens should be assessed. If a feedyard has less than tens pens with cattle in them, all pens with cattle present should be assessed.

Additionally, there should an effort to assess pens, water troughs, feed bunks and cattle in areas such as the receiving/ shipping pens and hospital(s). The number of those areas assessed will be feedyard-specific and dependent upon the size of the feedyard and types of facilities available.

Recordkeeping and documentation

The Feedyard Assessment contains references to many types of records including documentation of Best Management Practices (BMPs). You may call BMPs standard operating procedures (SOPs) or protocols. A set of customizable, fill-in-the-blank, sample/template forms are provided as part of this guide. If you do not already have one or more of the documents referenced as part of the Feedyard Assessment, you are encouraged to use these provided forms "as-is" or make modifications to fit your operation. Sample content, in light gray font, is provided in light gray to help you understand the type of content that you should enter to complete each blank of the customizable forms.

Additional BQA resources may be downloaded at www.bqa.org or http://www.iabeef.org/resources/producer-resources/iowa-beef-quality-assurance-program. These resources may serve as additional offerings for beef producers and local veterinarians that may come to your farm for other herd health issues or emergency calls.

1. BQA Feedyard Assessment - Booklet designed to help all cattle feeders benchmark their operations in areas such as animal welfare, cattle handling, record keeping, etc.
2. BQA Stocker Assessment - Designed to help all stockers benchmark their operations in areas such as animal welfare, cattle handling, record keeping, etc.
3. BQA Cow-Calf Assessment - Booklet designed to help all cow-calf producers benchmark their operations in areas such as animal welfare, cattle handling, record keeping, etc.

Herd health considerations for maximizing reproductive outcomes

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Introduction

Reproductive efficiency on a cow-calf enterprise is one of the most important parameters that affects profitability for the beef producer. The ultimate goal for most producers and veterinarians is to provide an optimal plan for a successful outcome by getting as many live and healthy calves on the ground as possible. There are many reasons for suboptimal or poor reproductive performance, including but not limited to: poor conception or pregnancy rates, early embryonic death (EED), mid-late term abortions, or weak/poor neonatal calf health aka "weak calf syndrome". Most of the reproductive parameters can be controlled at the producer level. Many reproductive losses can be minimized by proper management techniques to control or reduce the risk of reproductive issues in the breeding cattle herd, specifically with infectious diseases.

Abortions

Abortions are traditionally frustrating and can cause a financial devastation for some cattle producers, especially in "abortion storms" where 60% loss of future calf crop can occur. Ideally, the ultimate goal is to have limited or no abortion events, however in reality, many herds should expect normal abortion losses (1-3%). The objective after an abortion(s) should be to figure out a definitive cause and devise a plan to eliminate and/or prevent future occurrences, whether it be in the current calving season, if possible, or in future calving seasons. However, the success rate of accurate/definitive etiologic diagnosis is <50% (Anderson, 2007), even with modern-day diagnostic capabilities. Limitations, which include proper timing, diagnostic capabilities, adequate tissue submission, and lack of pathologic findings account for the low diagnostic rate, which equates to most abortion cases being diagnosed as "idiopathic" or "of unknown in origin".

Most abortions are a result of a single/isolated incident which can prevent or inhibit adequate information to elucidate a problem. Sporadic abortions are notoriously the most frustrating cases due to the lack of consistency and will complicate a herd-approach diagnostic workup. Many investigators use a benchmark of 2-5% abortion rates as an indicator for a potential problem, however, the first abortion can be the most important one by potentially offering information to change management decisions to prevent further losses.

Infectious agents can cause abortions, however many of the infectious agents are not contagious and are natural inhabitants or ubiquitous in the soil and the surrounding environment (examples: E. coli, Bacillus sp., and Trueperella pyogenes, and fungal organisms). These agents usually are eliminated by the cow/heifer through their immune system, however with excessive stressors the animal can be compromised enough to allow the opportunistic agents to invade the bloodstream and cause damage to the placenta and growing fetus at any particular part of gestation causing fetal loss (Engelken and Dohlman, 2015).

Contagious abortion pathogens include viral (IBR and BVD) and protozoal (Neospora) agents. These specific contagious agents can cause "abortion storms". In addition, viral and protozoal infections/outbreaks can cause a significant negative impact on reproductive performance including decreased conception and pregnancy rates, early embryonic abortions, and infertility that may go unnoticed or undiagnosed.

It is important to remember that not all abortions are infectious or contagious, even though they are targeted through diagnostics, and it is important to understand that other factors could cause abortions at any given time during gestation. Some factors may or may not be detectable including: metabolic/hormonal abnormalities, nutritional imbalances, toxins, overt stress, and genetic abnormalities.

Table 1 highlights diagnostic laboratory data from Iowa State University Veterinary Diagnostic Laboratory (ISU VDL) with the distribution of causes of abortion in beef cattle over the past 5 years. During this 5 year overview, 72% of abortion work-ups equated to an idiopathic or unknown cause for the abortion. Generalized abortions were given to 170 cases (27.8% of total), including unidentified and identified bacterial abortions (107 cases, or 17.5% of total), unidentified and identified fungal abortions (24, 3.9%), identified viral abortions (24, 3.9%), unidentified and identified protozoal abortions (10, 1.6%) and toxin induced abortions (5, <1%).

Table 1. Beef cattle abortions at ISU VDL (613 Cases: 2011-Current)

Diagnosis	Number (n)	% of Total
Idiopathic/Unknown	443	72.3%
Bacterial	107	17.5%
Fungal	24	3.9%
Viral	24	3.9%
Protozoal	10	1.6%
Toxin	5	0.8%

Specific bacterial diagnoses were found in 72 cases, with Bacillus sp. (25, 23.4%), Arcanobacterium pyogenes (11, 10.3%), Listeria monocytogenes (8, 7.5%), Ureaplasm sp. (6, 5.6%), and Campylobacter sp. 6, 5.6%) being the most common bacteria isolated from aborted tissues. Specific viral diagnosis were found in 24 cases, with Infectious Bovine Rhinotracheitis (IBR) virus (18, 75.0%) and Bovine Diarrhea Virus (BVD) (6, 30.0%) being the isolated virus from infected tissue (Table 2).

Table 2. Abortion agents based on category at ISU VDL (170 Cases: 2011-Current)

Agent Category		Number (n)	% of Total Category
Bacterial	Unidentified	33	30.8%
	Bacillus sp.	25	23.4%
	Trueperella pyogenes	11	10.3%
	Listeria monocytogenes	8	7.5%
	Ureaplasm sp.	6	5.6%
	Campylobacter sp.	6	5.6%
	E coli	4	3.7%
	Leptospira sp.	4	3.7%
	Salmonella sp.	2	1.9%
	Staphylococcus sp.	3	2.8%
	Bibersteinia trehalosi	1	0.9%
	Mycoplasm sp.	1	0.9%
	Pasteurella multocida	1	0.9%
Viral	Infectious bovine rhinotrachetis (IBR)	18	75.0%
	Bovine viral diarrhea (BVD)	6	25.0%
Fungal	Unidentified	21	87.5%
	Aspergillus sp.	3	12.5%
Protozoal	Unidentified	3	30.0%
	Neospora sp.	7	70.0%
Toxin	Nitrates	5	100.0%

This data is very similar to the previously reported data from the Iowa State Veterinary Diagnostic Laboratory (Magstadt, 2014). Comparatively, the ISU VDL data is very similar to the previously examined diagnostic data across 3 different veterinary diagnostic laboratories in South Dakota, Nebraska, and Wyoming throughout a 10-year period (Yaeger, 1993). Interestingly, that data revealed higher diagnosed viral abortions than currently reported, probably influenced by efficacious vaccines and producer willingness to vaccinate to protect their herds, even though data shows that vaccinations are used less than 40% of the time on cow/calf operations for reproductive pathogens (NAHMS, 2007).

Diagnostic workup

Not all abortions can be prevented so it is in the best interest to investigate abortion events through diagnostic approaches in order to establish management changes for the current calving season and to prevent causes in future calving seasons.

It is very important to determine gestational period of abortion or reproductive loss due to some pathogens having classical tendencies to be more prevalent at differing stages of pregnancy (Kirkbride, 1992). This allows veterinarians and diagnosticians to develop a differential list and to narrow down possible etiologies (bacteria, viruses, fungi, protozoan, toxins, etc.) that may have caused the pregnancy loss. In addition, history is the most critical piece of an abortion workup. Without it, the possibilities are endless. However, if known exposures, changes to management, vaccination history, nutritional changes, etc. could be helpful in pinpointing potential causes and allowing judicious utilization of diagnostic tools to maximize a potential diagnosis.

In any abortion event, it is critical to have adequate samples for diagnostic testing. Table 4 is a preferable list of tissues and specimens that would be ideal to have for diagnostic testing (always confirm with diagnostician if they need additional samples):

Steps after abortion occurs:

1. Identify individual animal with appropriate id and isolate from the herd
2. Collect/Recover aborted tissue including fetus and placenta
   always wear gloves due to potential zoonotic risks
3. Call veterinarian as soon as possible to get them involved to submit adequate tissues to increase chances of getting a definitive diagnosis
4. Talk to diagnostician of laboratory of choice to make sure there is adequate information and samples
5. Package and chill samples and get samples to diagnostic lab ASAP
   never freeze samples as that could prevent adequate diagnosing

Table 4. Preferred tissue/specimen submissions for beef cattle abortion

Formalin-fixed	Fresh
Placenta	Placenta
Skeletal muscle (tongue/diaphragm)	Thymus
Ear notch	Lung
Thymus	Heart
Lung	Liver
Heart	Kidney
Liver	Spleen
Kidney	Lymph node
Spleen	Brain (1/2)
Lymph node	Stomach contents
Adrenal gland	Thoracic fluid
Brain (1/2)	

Management

There are many management considerations to eliminate or lower abortion causes and many of those management changes will also improve overall conception and pregnancy rates within the herd. Prevention is the key and it entails good husbandry and proper immune function to combat opportunistic pathogens and possible infectious (contagious/noncontagious) pathogens. Proper nutrition and eliminating stressors are fundamental management objectives. Eliminating possible exposure routes and minimizing immune system workload is crucial for successful elimination or lowering of opportunistic pathogens causing reproductive losses.

Vaccination

Vaccinations are an important tool to protect beef cow-calf herds, but the vaccination protocols need to be effective and selection is critical. Complete protection from every pathogen is impossible therefore understanding what disease risks are currently in the herd and what potential risk maybe carried into the herd is imperative (Spire, 1988). Vaccination protocols and programs need to be made on a herd-to-herd basis, as risks are different from farm-to-farm, specifically with farms that commingle cattle and/or introduce new animals within the resident herd. Evaluation of potential risk for exposure to certain pathogens and current management strategies is critical to effectively select vaccine needs and types and should always be consulted by a veterinarian. Vaccine type selection (MLV vs inactivated-killed) should be based on sound vaccination parameters focusing on timing and selecting vaccines based on exposure risks and evaluating herd history and current management practices. Vaccine development and technology has advanced in the past decade and has allowed for elimination of vertical transmission ("fetal protection") of viruses following manufacturing dosing and timing (Ficken et al. 2006) (Fairbanks et al.,2004).

Biosecurity

Preventing introduction of pathogens is essential to maintaining herd health and limit reproductive losses. Judicious use of vaccination can help bolster the immune status of the herd but it is important to remember, that there is no vaccine that can prevent a disease if the exposure is too great, meaning that even though vaccines are given there is still is an inherent risk depending on management decisions. Many reproductive infectious pathogens can be transmitted and spread through exchange of bodily secretions (respiratory, genital, semen, etc.) or by direct contact with fomites (equipment and boots). Traditionally, cattle represent the main reservoir for most of the infectious causes of reproductive loss, therefore newly acquired animals should go through proper quarantine procedures and be tested or vaccinated to eliminate potential spread of infectious agents. Replacement heifers and breeding bulls should receive extra management considerations as those groups represent the greatest biosecurity risks (Newcomer et al., 2016).

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Beef-cattle market situation and outlook: 2017 and beyond

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The contrast between the beginning of 2015 and the beginning of 2016 was stark in the beef cattle markets. 2015 was a year of transition as the markets turned the corner from upward-trending prices to the reality of growing cattle inventories and the beginning of cyclically lower prices. The beef industry's transition to larger supplies in 2016 was abrupt with even further decline in prices. It's important to remember that markets often overshoot and then undershoot as they continue to adjust in search of the equilibrium price.

There continues to be a wide variation of opinions about the cattle markets in 2017 and beyond. Clearly, wide swings in the cattle markets over the past several years has made it difficult to establish benchmarks of what a high price, or a low price, or the "right price" for cattle should be.

It's been said that cattle prices have lost their price reference points. Examining and quantifying opportunity (risk) associated with a higher (lower) prices has been difficult. Major price swings have had major financial consequences on participants in beef cattle production, from cow-calf operations, to stocker/backgrounders, to feedlot owners.

Year over year declines in cattle prices are forecast for 2017, but the pace of price drops is expected to moderate significantly. The largest proportion of the adjustments to occur in the current cattle price cycle likely have already happened.

USDA's Agricultural Projections to 2026 can be used to take a longer view on prices. Figure 1 shows calf, feeder cattle, and fed cattle prices have returned to 2011-2013 levels. USDA analysts who use fundamental price models are forecasting these price levels to continue. These price levels, and price relationships, provide at least a starting point for informing long-term investment and management decisions. For example, I utilize these price projections for calculating the net present value of beef replacement females, i.e., the maximum bid price.

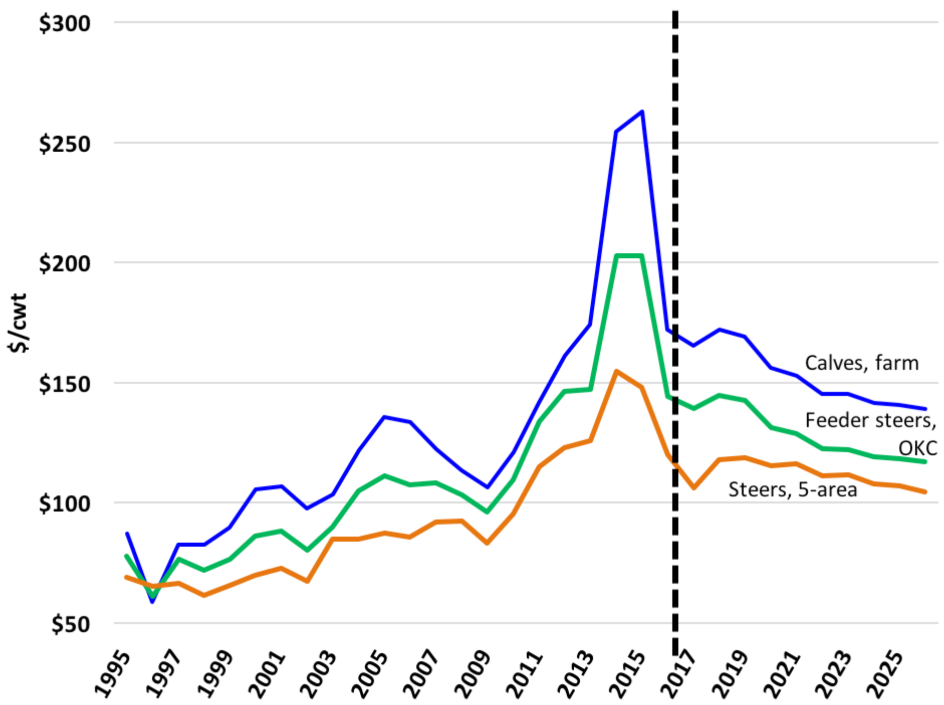

Figure 1. USDA Beef Cattle Price Projections to 2026. Data Source: USDA-ERS. November 2016.

Any long-run projections are going to reflect near-term market adjustments and longer term prospects. In the cattle industry, nothing is certain, but there are some key factors worth mentioning for 2017 and beyond.

Beef cattle herd expansion status

The January Cattle report, which will be released by USDA on January 31, will provide an indication of continued beef cattle herd rebuilding, heifer retention, feeder cattle supplies, and the size of the 2016 calf crop. With the dramatic adjustments in cattle prices over the last several years, cattle producers are understandably very concerned about the status of herd rebuilding as they make decisions that will position them for production in 2017 and beyond.

The U.S. beef cow herd is likely still increasing, but signs of a slower growth rate are expected to emerge. The beef cow herd is expected to show growth of another 1.5% to 2.5% in 2016. Added to the expansion in 2014 (up 0.7%) and 2015 (up 3.5%), the January 1, 2017 beef cow herd inventory is likely to be near 31 million head (figure 2). This puts the beef cow herd inventory back to the level at the beginning of 2011; before drought liquidation dropped the herd by two million head.

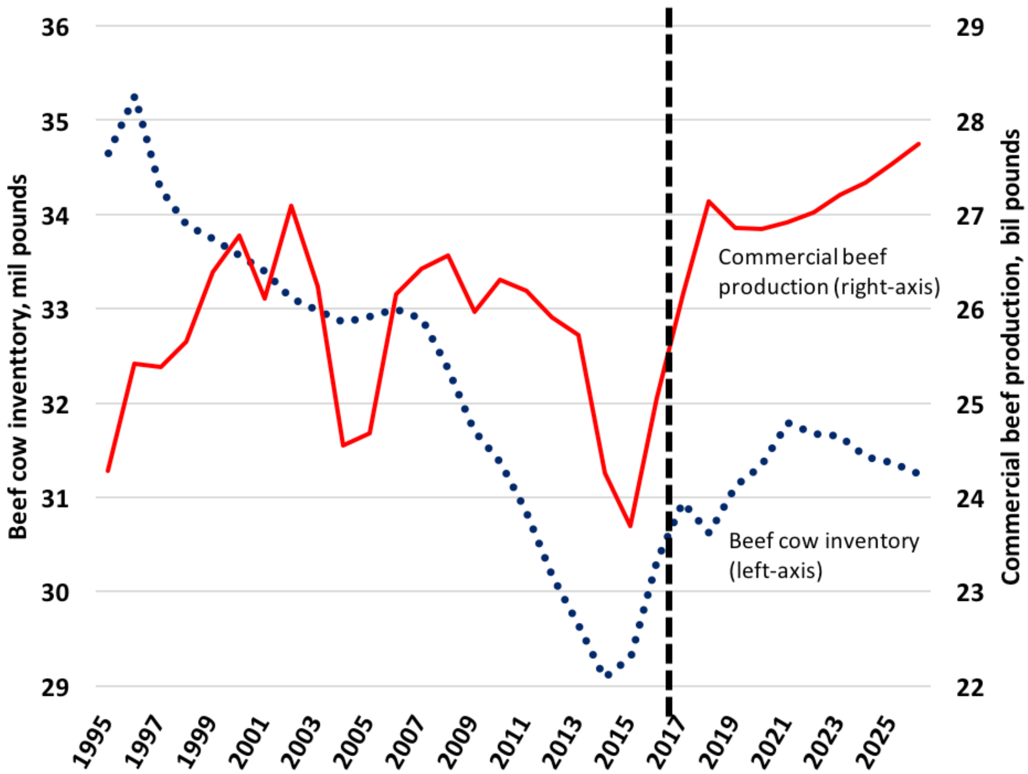

Figure 2. USDA Beef Cow Inventory and Commercial Beef Production Projections to 2026. Data Source: USDA-ERS. November 2016.

The need for additional herd expansion in 2017 and beyond will be highly debated, but what can be agreed upon is expansion thus far has not been very much. The national beef cow herd is unlikely to return to historical levels as fewer cows are needed to hit a given beef production target; the result of larger slaughter weights. Along with domestic beef demand, international demand for U.S. beef will determine just how big the U.S. beef industry needs to be as it expands.

Beef markets adjusting to increasing supplies

Increased production is the main supply driver in the market place, and hence the price lowering factor. Beef prices are coming down from record levels at the wholesale and retail levels. In 2016, Choice boxed beef prices averaged 13.8% below 2015 levels with Select boxed beef prices averaging 15.0% below year earlier levels. Through November 2016, Choice retail beef prices averaged 5.1% below year ago levels while All Fresh retail beef prices were down 4.9% year over year.

Several factors explain why retail beef prices have adjusted less than wholesale beef prices. First is the long time lag in production. The dynamics of beef supply are complex and take time to move through all market levels. Thus, supply increases will pressure prices in cattle markets and wholesale markets well ahead of adjustments in retail markets. And, the price effect is typically more muted the further away you get from the raw product. Second, changes in beef production do not translate directly into retail beef supplies. Beef production increased 6.4% year over year in 2016. However, the domestic retail beef supply was up only 3.1% when production was adjusted for beef imports and exports.

International trade role looms large for cattle and beef markets

International trade of cattle and beef provides a significant buffer that reduces drastic market swings in U.S. markets. In 2014 and 2015, record high U.S. prices and reduced supplies had the expected effect of stimulating cattle and beef imports while hindering beef exports. A strong U.S. dollar exaggerated those effects both ways.

Increased beef production and lower prices in 2016 has reversed those impacts. Beef exports in November were 25.0% above last year with year to date beef exports up 10.9%. Conversely, beef imports were down 11.6% year to date. Total cattle imports were down 22.9% year to date.

Decreased beef imports and growing beef exports will play a central role in stabilizing cattle and beef prices in the U.S. as production continues to expand in the coming years. More than just total tonnage, beef exports and imports are critical in balancing the supply and demand of specific beef products. This helps maximize the value of every beef carcass in the U.S. market.

Rising production should moderately lift domestic per capita beef consumption in the years ahead. Still, U.S. per capita consumption may not return to what it was decades ago. Rather than merely jockeying for U.S. market share, industry participants will keep looking outside the U.S. for profitable growth. The percent of total U.S. beef exports to domestic U.S. production was 10% in 2016. This compares to 21% in pork and 16% in broilers.

Trade relationships, exchange rates, and economic growth rates in other countries will all influence the export demand profile. However, these are difficult to anticipate, especially in the current geopolitical environment.

Keeping in position

From a producer's perspective, for the few years leading up until 2015, betting on higher cattle prices worked well, but the situation has changed. Cattle supplies and beef production are now consistently growing rather than shrinking and prices are notably lower. Time should be spent developing a clear marketing plan (including price risk mitigation options), understanding cost structures, and preparing for opportunities before they arise.

There are many factors to consider in attempting to reduce price risk and uncertainty. A short list includes: enterprise combination, cash flow needs, and financial situation, as well as personality and attitude toward risk. One key goal is to reduce the variability of income over time, or at least guarantee a minimum level of cash flow. This allows more accurate planning for items such as debt payment, replacing capital assets and operation growth. A second goal is to ensure some minimum income level to meet family living expenses and other fixed expenses. A third reason for minimizing price risk is to enhance the survival of the operation. Making a business judgement on how much loss a business can withstand is a key to putting a price risk management plan in place.

The cyclical price pendulum will swing back; producers that begin preparing now will be in a good position to quickly implement plans. For backgrounding operations and cattle feeders, opportunities in 2017 will likely be improved compared to the significant red ink of the last two years, still careful consideration should be paid to any opportunities to lock-in profits. Remember the goal of price risk management is to minimize risk by limiting losses and increasing the probability of profit.

Related and updated information is regularly available at:

- Iowa Farm Outlook & News (www2.econ.iastate.edu/ifo/)
- Iowa State University Ag Decision Maker (www.extension.iastate.edu/agdm/)
- Iowa State University Estimated Livestock Returns (www2.econ.iastate.edu/estimated-returns/)
- Iowa State University Livestock Crush Margins (www2.econ.iastate.edu/margins/).