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Profitability of Preconditioning: Lessons Learned from an 11-Year Case Study of an Indiana Beef Herd

W. Mark Hilton[1], *DVM, DABVP;* **Nicole J. Olynk**[2], *PhD*
[1]*Purdue University School of Veterinary Medicine, West Lafayette, IN 47907*
[2]*Department of Agricultural Economics, Purdue University, West Lafayette, IN 47907*

Abstract

The objectives of this study were to assess the profitability of preconditioning calves in a commercial beef cow setting, and to determine factors associated with profit from preconditioning. The herd owner identified an overarching goal within the project: to supply a higher quality calf to the feedlot and capture the increased value of that calf to improve profitability.

Results indicated that preconditioning was profitable for this example herd, with an average return to labor and management of $80.70 per calf per year for preconditioning. Returns ranged from $26.04 to $116.48 per calf per year, and profitability improved as the manager's experience with managing the preconditioning component of the operation increased. The preconditioning enterprise was profitable in each of the 11 years of the study.

Factors related to profit from preconditioning included average daily gain, days-on-feed, cost of gain, and feed cost of gain. Health concerns in this example were minimal; morbidity was 0.09% (1 of 1,103) and mortality was 0.27% (3 of 1,103). Overall, returns to preconditioning were primarily due to added weight sold (63% of return to preconditioning) with the preconditioning health sales price advantage adding the remaining 37%.

Keywords: beef, calves, cow-calf, preconditioning

Résumé

Les objectifs de cette étude étaient d'évaluer la rentabilité du préconditionnement des veaux dans un élevage commercial de vaches et de taureaux et de déterminer les facteurs associés à la rentabilité du préconditionnement. Le propriétaire du troupeau a identifié un objectif global pour le projet : produire un veau de plus grande qualité pour l'engraissement et utiliser la plus grande valeur du veau pour accroître la rentabilité.

Les résultats indiquent que le préconditionnement était rentable dans ce troupeau à l'essai. Le retour moyen du préconditionnement pour la main d'œuvre et la régie était de 80.70$ par veau par année. Les retours variaient de 26.04$ à 116.48$ par veau par année et la rentabilité augmentait en parallèle avec le niveau d'expérience des régisseurs à gérer la composante préconditionnement de l'opération. Le préconditionnement a été rentable à chacune des 11 années de cette étude.

Les facteurs suivants étaient associés à la rentabilité du préconditionnement : le gain moyen quotidien, le nombre de jours d'alimentation, le coût du gain et le coût d'alimentation du gain. Il y a eu peu d'inquiétude au niveau de la santé dans ce troupeau; la morbidité était de 0.09% (1 sur 1103) et la mortalité de 0.27% (3 sur 1103). Dans son ensemble, le préconditionnement s'avérait rentable principalement en raison du poids additionnel à la vente (63% des retours du préconditionnement) et de l'avantage relié à la meilleure santé pour le prix de vente (37%).

Introduction

The concept of preconditioning, or preparing beef calves to enter a feedlot environment, was conceived in the mid-1960s by Iowa State University extension veterinarian Dr. John Herrick (personal communication, Nolan Hartwig, Iowa State University, 2010).[10] The goal was to decrease morbidity and mortality in the feedlot by supplying a calf that was vaccinated, castrated, dehorned, dewormed, weaned, and trained to eat from a bunk and drink from a water tank (personal communication, Nolan Hartwig, Iowa State University, 2010).[1,10] In 1967, Oklahoma State University hosted a national conference to discuss preconditioning.[14] Some skepticism was evident when the process was initially described, but by the mid-1970s about 600,000 calves were preconditioned in Iowa (personal communication, Nolan Hartwig, Iowa State University, 2010).[10]

Numerous papers, summarized in Table 1, have demonstrated that the concept of preconditioning is sound in the health production sense, but the economics of the program for the cow-calf producer and/or feedlot owner have often been questioned.[2,3,5,6,8,9,13,16,17,20] While most studies of the economics of preconditioning focus on the bonus or premium received due to the health benefits, exploring other factors under the producer's

Table 1. Summary of previously completed analyses of preconditioning programs.

Year	Location	Actual/ simulation	Author	Labor included?	Days PC[a]	ADG[b] (lb)	Cost to PC	Cost of gain	PC bonus	Shrink included?	Weight gain (lb)	Mortality	PC profit/hd
1996	UT	S	Bailey/Stenquist	Y	45	1.33	$56.00	$93.00		N	60	1%	
2002	OK	S	Lalman/Smith			1.5-2	$35.00-60.00		$3-8				$50-75
2002	TN	A	Rawls	N	57	1.84	$43.33	$41.26		Y	105		$49.17
2002	TN	A	Rawls	N	47	2.92	$58.92	$42.09		Y	140		$45.98
2002	TN	A	Rawls	N	59	1.72	$54.03	$52.97		Y	102		$25.11
2002	TN	A	Rawls	N	60	2.95	$63.45	$35.85		Y	177		$70.20
2002	TN	A	Rawls	N	45	2.14	$61.93	$64.51		Y	96		$26.59
2003	OK	S	Avent	Y	45	1.5	$60.92	$90.25	$3.30	Y	67.5	.5%	-$6.93
2003	OK	S	Avent	Y	45	1.2	$60.86	$112.70	$3.30	Y	54	.5%	-$19.00
2003	OK	S	Avent	Y	45	1.8	$60.98	$75.28	$3.30	Y	81	.5%	$5.14
2003	OK	S	Avent	Y	45	1.5	$59.39	$87.99	$3.30	Y	67.5	.25%	-$5.40
2003	OK	S	Avent	Y	45	1.5	$62.45	$92.52	$3.30	Y	67.5	1%	-$8.46
2003	OK	S	Avent	Y	45	1.5	$56.92	$84.33	$3.30	Y	67.5	.5%	-$2.93
2003	OK	S	Avent	Y	45	1.5	$64.92	$96.18	$3.30	Y	67.5	.5%	-$10.93
2004	KS	S	Dhuyvetter	Y	45	1.33	$56.97	$85.35	$4.00	N	60	.25%	$12.94
2004	KS	S	Dhuyvetter	Y	45	1.00	$56.95	$109.25	$4.00	N	45	.25%	$6.19
2004	KS	S	Dhuyvetter	Y	45	1.67	$56.98	$69.90	$4.00	N	75	.25%	$19.40
2004	KS	S	Dhuyvetter	Y	45	1.33	$61.04	$91.45	$4.00	N	60	1.00%	$8.87
2004	KS	S	Dhuyvetter	Y	45	1.33	$68.03	$101.91	$4.00	N	60	.25%	$1.88
2006-2007	NM	A	Mathis		49-53	1.1							-$66.38
2006-2007	NM	A	Mathis		49-53	1.8							-$86.92

Note: Number of calves and morbidity were not reported.
[a]PC - Preconditioning
[b]ADG - Average daily gain

control could potentially be more fruitful. Avent and Lalman noted, "Our results indicate that price premiums, although evident, appear to be insufficient by themselves to cover the marginal costs of preconditioning".[2] They mentioned added weight only briefly, and even then it was seen as a neutral factor in the program at best and stated, "Marketing heavier preconditioned calves means receiving a lower absolute price, but marketing more pounds of calves".[2] Mathis stated correctly that "the marginal value of the additional gain declines as rate of gain increases," but said little about the very efficient gain of newly weaned calves.[16]

The average price premium reported by King *et al* was $7.36 per cwt (100 lb [cwt] or 45.45 kg) for the VAC-45 program for years 2003 to 2005, and in these same years the price reduction per 100 lb of bodyweight as calves moved to heavier weights, or price slide, was $6.50 per cwt.[12] Using these prices for a 550-lb (250 kg) calf valued at $120 per cwt allows us to examine the influence of average daily gain (ADG) and costs of preconditioning on overall profit. To break even on the enterprise, total expenses must be under $61 per head if calves gain only 1.0 lb (0.45 kg) per day during the preconditioning period, whereas expenses can be as high as $133 per head if calves gain 3.0 lb (1.36 kg) per day.[16]

While recent studies have shown an ever-increasing premium paid for preconditioned calves (personal communication, KS Hendrix, 2000), there is still the question for beef cow-calf producers of cost-effectiveness of preconditioning on the farm or ranch. Many studies were simulations or sample budgets of expenses, revenues, performance, and health of preconditioned calves,[2,3,9,13] while others were actual trials with all data recorded[17,20] (Table 1). Previous analyses used the term "preconditioning" when describing calves with no history that were purchased from a sale barn and then vaccinated, castrated, dehorned, and started on feed.[22] A more appropriate term for this would be "backgrounding high-risk calves". Table 1 summarizes numerous reports published previously while Table 2 summarizes the test herd data.

While studies show that the increased value of a preconditioned calf to the feedlot is $9.92-$11.04 per cwt, feedlots will continue to buy calves as economically as possible.[6] For the producer to have the greatest chance for economic reward in a preconditioning program, the focus must be on items the producer can control, including health, genetics, nutrition, environment, and marketing (choice of markets). If these factors can work in harmony, the likelihood that preconditioning will be profitable for the producer is increased.

Materials and Methods

Indiana Beef Herd Farm Case Study

This study was conducted from 1999 to 2009 on a

Table 2. Indiana Quality Plus Beef (IQ+BEEF) demonstration herd: summary of health, performance, and economic gain.

Year	Actual/ simulation	Labor included?	No. of calves	Days PC[a]	ADG[b] (lb)	Cost to PC	Cost of gain	PC bonus	Shrink included?	Weight gain (lb)	Morbidity	Mortality	PC profit
1999	A	N	80	48	1.21	$39.29	$61.94	$3.06	Y	58	0	0	$55.26
2000	A	N	92	49	1.47	$41.30	$55.82	-$3.51	Y	72	0	0	$26.04
2001	A	N	100	46	1.91	$35.31	$37.33	$6.14	Y	88	0	0	$30.54
2002	A	N	106	53	2.22	$49.13	$35.55	$3.41	Y	117	0	0	$55.66
2003	A	N	95	46	2.87	$44.95	$29.59	$3.56	Y	132	1.05%	0	$106.79
2004	A	N	101	54	2.73	$56.29	$39.26	$7.37	Y	147	0	1.04%	$96.67
2005	A	N	106	56	2.57	$75.00	$39.54	$4.90	Y	144	0	0	$74.06
2006	A	N	110	64	2.65	$61.96	$34.59	$7.44	Y	169	0	0	$39.23
2007	A	N	109	65	3.05	$77.81	$41.81	$10.99	Y	199	0	0.92%	$116.48
2008	A	N	98	70	2.86	$115.00	$52.87	$11.36	Y	201	0	1.02%	$58.65
2009	A	N	109	70	2.74	$86.38	$43.28	$11.36	Y	193	0	0	$99.11

[a]PC - Preconditioning
[b]ADG - Average daily gain

commercial beef and grain farm with 245 acres of pasture located in southwest Indiana. The farm averaged approximately 125 cows during the 11-year test period. Cows were bred by natural service to begin calving on February 1, and calves were weaned the Friday before Labor Day. Prior to 1999, calves were trucked to the local feeder auction and sold the same day as unweaned, unvaccinated calves with no history except for the seller's name and reputation in the marketplace.

Pastures were primarily endophyte-infected Kentucky-31 fescue, with most fields interseeded with some red clover. Grazing in the different fields ranged from continuous grazing to rotational grazing of four paddocks. In most years pastures were clipped once annually to control weeds and encourage mature fescue to return to a vegetative state.

Historical average temperatures in August, September, and October at the weather station closest to the farm are 76°F (24°C), 69°F (21°C), and 58°F (14°C), respectively, with average highs of 87°F (31°C), 81°F (27°C), and 70°F (21°C). Precipitation averages for the same months were 3.0 inches (7.6 cm), 2.8 inches (7.1 cm), and 2.7 inches (6.9 cm), and elevation is 394 feet (120 meters).[24]

In 1995, the herd owner joined the newly formed Indiana Beef Integrated Resource Management (IRM) program for three major reasons: 1) to 'force' the farm to take calf weights (which was considered a necessary step towards improvement of the herd); 2) to take advantage of a "free" program where the producer would receive assistance on herd improvement from the Purdue Beef IRM team; and 3) to improve the profitability of the beef portion of the agricultural enterprise. In an interview in June 2010 the owner said, "If we could not find a way to make a reasonable profit with the beef cows, we were ready to sell them". In the spring of 1999 the Purdue Beef Team initiated the Indiana Quality Plus Beef (IQ+BEEF) Program. This is a Beef Quality Assurance (BQA) and preconditioning program with the goal of adding value to feeder calves sold in the state of Indiana. The owner of the herd was positive about the potential benefits of the program and did not sell calves at weaning, but preconditioned his calves before selling them in the fall of 1999.

In the financial analysis of the profitability of the preconditioning period, all input costs and revenues generated were the actual prices paid and received by the participating farm. To compare our preconditioned value with the previous system, where unweaned, unvaccinated calves were sold in early September, we assigned a value for the calves as if sold the day of weaning. To value the calves on the day of weaning, we used the average price of calves at the 25 feeder calf auctions in Kentucky listed on the Kentucky agricultural website (www.kyagr.com/marketing/marketreports/archive.htm). This price at weaning was used as the comparison or base price throughout the study, as it represents the price received under the production system without preconditioning. Average calf weights were calculated for steers and heifers, and calf value was assigned by extrapolating average calf weight to the appropriate weight relative to the 100-lb weight spread reported by the Kentucky Department of Agriculture. For example, if steers averaged 490 lb (222 kg), and calf prices in Kentucky averaged $109.13 for 400 to 500 lb (181-227 kg) steers and $104.91 for 500 to 600 lb (227-272 kg) steers, the price slide for added weight was $4.22 per cwt. We assumed that the average calf in the 400 to 500

lb weight range weighed 450 lb (204 kg). As a result, 490-lb steers were discounted $1.69 per cwt [(490 - 450 lb) x $.0422 per lb] due to the additional weight above 450 lb. The value then used was $107.44 per cwt. A 5% shrink was applied to the calves, and this figure was used to calculate the value of the calves if they had been sold at weaning.[18,21] An interest expense of 8% of calf value was charged from weaning date until sold.

The price received for the calves was either the actual price received at the feeder calf auction or the actual price received through private treaty sale. When calves were sold private treaty (eight out of 11 years) the price was figured as the midpoint between the average and highest price for calves in that weight range in the Kentucky auction sales previously identified. In essence, the test calves sold in the 75th percentile of calves selling that week based on the 25 Kentucky feeder calf auctions.

The herd owner recorded all time spent on calves after sorting on the day of weaning (total spent in the preconditioning enterprise) from 2007 to 2009. The return to labor and management of preconditioning, on an hourly basis, or the profit divided by the total hours of labor, ranged from $54.74 to $130.22 per hour.

Return to labor and management was calculated in this analysis. It is acknowledged that the return is heavily influenced by the specific situation of the farm business with regard to facilities, equipment, and capital structure. For the farm analyzed in this project, no new equipment was purchased from 1999 to 2009. Some minor repairs were made to feedbunks, but all were in place before 1999. Trucking expenses were not included in this analysis as it is expected to be a similar expense with and without preconditioning of calves.

Calves were preconditioned in a well-drained drylot with approximately 200 square feet (18.6 m^2) per calf. Calves had trees for shade and a windbreak, but no other shelter. Calves had approximately 10 inches (25.4 cm) of bunk space per calf in 1999, which was increased to 14 inches (35.6 cm) per calf in subsequent years. For the first 10 days in the drylot, calves were fed twice daily with all hay, grain, supplement and/or corn gluten feed fed in the bunk as a total mixed ration. After the 10-day acclimation period, calves were fed the same grain mix twice daily in the bunk, but had ad libitum access to large, round bales of mixed grass-legume hay fed in hay feeders. Water was available from an automatic water fountain within 100 feet (30.5 m) of the hay and grain.

Calves were not creep fed, but cows were given approximately 5 lb (2.3 kg) of dry corn gluten feed per head every few days starting about two weeks before weaning to train cows and calves to come into a sorting-loading facility to simplify the pre-weaning-vaccination process. As weaning time became closer, the feeding frequency increased to almost a once daily occurrence. By weaning, the calves were also consuming a small amount of the corn gluten feed.

All calves were administered a modified-live infectious bovine rhinotracheitis–bovine viral diarrhea virus–parainfluenza-3 virus–bovine respiratory syncytial virus (IBR-BVD-PI$_3$-BRSV)[a] vaccine, and from 1999 to 2006, growth promoting implants[b] were given two weeks pre-weaning. Starting in 2007, a feeder of "all-natural" calves contracted to buy the calves, therefore no implants were used. Calves came from five to six pastures, and were trucked to the preconditioning lot where they received another MLV IBR-BVD-PI$_3$-BRSV[a] vaccine, 7-way clostridial bacterin-toxoid,[c] and pour-on dewormer.[d] In 2005, a *Mannheimia haemolytica* type 1A–*Pasteurella multocida* bacterin[e] was added to the vaccination schedule. A calf died 26 days after weaning in 2004 and a necropsy was performed by the private practice, herd health veterinarian. Tissue samples were submitted to the Heeke Animal Disease Diagnostic Laboratory, located at the Southern Indiana-Purdue Agricultural Center (SIPAC) near Dubois, IN. *Mannheimia haemolytica* was recovered from the lung tissue, and the owner opted to add this vaccine to the preconditioning protocol.

Results

Since the data used are actual expenses incurred and revenues received, some year-to-year variation in prices was inherent. Therefore, we emphasized the 11-year average and trends to make recommendations for utilizing preconditioning in a commercial beef herd. Table 2 shows the actual costs, revenues, and profits for the herd investigated in this analysis. In 1999, the herd had a net return of $55.26 per calf for preconditioning. When analyzed, it was found that 63% of the profit was due to added weight sold, while 37% was due to the market's price advantage for preconditioning health. In 2000 we had a "negative" preconditioning basis. The special IQ+BEEF sale was well below the target for the projected number of lots, and calves sold about $3.50 per cwt below the average Kentucky reference price for the week. As a result, the $26.04 made on these calves was due entirely to weight gain. In actuality, the weight gain profit was $45.49 per head with a marketing or preconditioning loss of $19.45 per head.

In 2001, the owner negotiated a private treaty price of $90.00 per cwt when the Kentucky composite price was $83.86 per cwt, for a price advantage of $6.14 per cwt. From 2002 to 2005, the value of added weight exceeded the preconditioning bonus. It became obvious that adding weight economically was one of the keys to profitability when preconditioning.

Calves were always heavier at sale time after preconditioning compared to the earlier marketing time. As calves add weight, the price per cwt generally

decreases. In the study herd, 15 of 18 sale periods for which data were recorded resulted in a price decrease associated with added weight. Based on the data used in this analysis, seasonality of selling had little effect on price. According to data from 1995 to 2004 in Kentucky, 500 to 600 lb steers sold in October at a 2% discount to those sold in September.[18]

Real data from a commercial beef herd was utilized in this analysis; therefore, extrapolating this data to other operations is not without challenges. Two major price-altering agreements were entered into during the study period that should be noted. In 2006, a new buyer purchased all the calves and his goal was to feed the steers and breed the heifers. He requested that the heifers be fed a ration much lower in energy to avoid getting them too heavy or obese for the breeding program. A ration was formulated for the heifers to gain 2.2 lb (1.0 kg) per day and the actual gain was 2.32 lb (1.05 kg) per day. The owner was paid a premium of $8.50 per cwt for these heifers due to the caloric and subsequent weight gain restriction. This figure shows up in the "bonus for PC" figure, when it is actually more of a "bonus for restricted weight". From 2007 to 2009 a seller of "all-natural" beef contracted to purchase the calves, therefore no implants or ionophores were used. The cow-calf producer was paid a premium of $6.00 per cwt for this restriction because of decreased gain and feed efficiency from not using implants or ionophores.[15]

Discussion

The interaction of health, environment, genetics, technology, marketing, and nutrition played an additive role in improving profitability on this farm. The use of a diverse set of expertise was critical in the overall success and return on investment. While early year's data from this IQ+BEEF Demonstration Herd mimics much of the data in the literature, more recent results show significantly higher calf performance, lower cost of gain, lower morbidity, increased preconditioning price advantage over time, and increased profit. This suggests that preconditioning takes time to master, and perhaps numerous trials from first-time users gives a negatively skewed view of the rewards of the program.

Nutrition

Improved nutrition played a role in increasing profitability of this beef cattle operation. Before 1999 the herd owner had not fed any calves after weaning. The marketing plan was to sort unweaned, unvaccinated calves from the cows on the Friday before Labor Day and take them immediately to a local feeder auction. The calves were not creep fed, but did receive a small amount of concentrate as explained earlier.

The preconditioning ration used in 1999 was 4.5 lb (2 kg) of shelled corn and 1.25 lb (0.57 kg) of an all-natural commercial protein supplement. The grain portion of the ration was divided into two feedings each day in a bunk. Calves also had ad libitum access to large, round bales of fescue hay. When asked about how the ration was developed, the herd owner admitted a heavy dependence on opinions from neighbors that fed out a few calves for freezer beef. Their opinions included cautionary tales about getting calves too fleshy before selling because buyers would discount fleshy calves. This advice became the cornerstone of the nutritional plan, and produced a gain of only 1.21 lb (0.55 kg) per day the first year on the program. During a herd visit two weeks before the anticipated sale, it was determined that about 20 to 30 of the 80-head lot should be held back and fed additional grain because of poor body condition score (calves ranged from 3.5 to 5) and large "hay bellies". The owner declined due to labor constraints, and sold all calves at the special preconditioned sale after 48 days-on-feed.

While the cautions surrounding getting calves too fleshy were heard many times when discussing the concept of improving gain to improve profitability of preconditioning, the research on the subject is not as negative. When data was analyzed on 84,319 feeder calves selling in approximately 8,200 lots in Kansas and Missouri in 2008 and 2009, the discount for calves of "fat" condition was $0.86 per cwt, and they made up only 6.4% of all calves sold.[23] Similarly, a 2000 Missouri study of 1,249 lots of cattle found that 243 lots, or 24.46%, were deemed "fleshy", and were discounted $0.60 per cwt by the buyers.[2] In a similar study in Arkansas with 105,542 calves in 52,401 lots, the discount for "fleshy" calves was $5.82 per cwt with 2.9% of the calves classified as "fleshy".[4] In all three studies there was one additional category where calves were determined to carry even more condition than those mentioned above, so calves classified as "fat" or "fleshy" did not have the highest body condition when offered for sale.

When interviewed, the owner indicated he was unaware of options beyond corn, soybean meal-based protein supplement, and hay for feeding calves. He was also unaware that numerous feedstuffs could be used to formulate a lower cost, balanced ration. In 1999, soy hulls and dry corn gluten feed were readily available in his area.

Figure 1 shows the ADG of calves on this farm steadily increased from 1999 to 2003. During this time the Purdue Beef IRM team took a more active role in providing nutritional consultation. A computer-based ration formulation program[f] was utilized to develop a low-cost ration that produced improved gains. Numerous times throughout the early years the owner and others reminded the team to not allow the calves to get

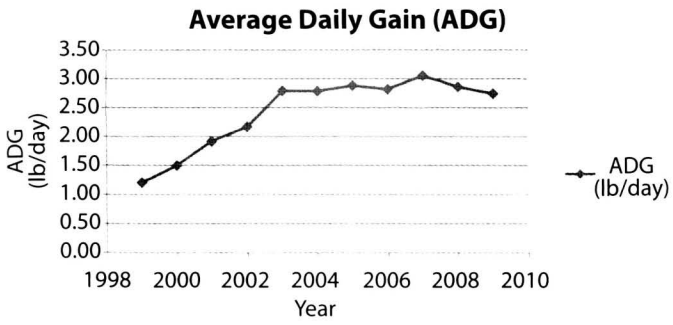

Figure 1. Annual average daily gains for beef calves preconditioned in the Indiana study herd for the years 1999–2009.

too fleshy because buyers would discount them. After consulting with a beef nutritionist in 2000, a ration was formulated for calves targeting a gain of 1.5 lb (0.68 kg) per day (personal communication, KS Hendrix, 2000). The ration included 3.5 lb (1.59 kg) corn, 8 lb (3.63 kg) soybean hulls, 0.5 lb (0.23 kg) of a commercial supplement, and hay was limit fed at 2.5 lb (1.13 kg) per day for the first two weeks and then fed ad libitum after that. The actual gain achieved on this ration was 1.47 lb (0.67 kg) per day.

Each year from 1999 to 2003 the ration was reformulated to allow increased growth in the calves during the preconditioning period (Table 3). After achieving an ADG of 2.87 lb (1.30 kg) per day in 2003 with no calves (0 of 95) classified as "fleshy", the questions from the owner and others about this concern ceased. It was obvious that excellent preconditioning gains could be achieved without getting calves too fat.

From 2004 to 2009 the ration was adjusted based on prices of various feedstuffs as the owner became more aware of feedstuff value. Figure 2 shows that, looking at each of the individual year's data as an individual observation, profit increased as ADG improved. With higher ADG, a greater percentage of the nutrition was accreted into added weight and a lower percentage was being used for maintenance functions.

Table 4 depicts the return to labor and management per calf for 2008 and 2009. The comparison of 2008 and 2009 performance is informative because performance is similar and the days fed (70 days) are the same, but return to labor and management is quite different. The cost of gain decreased in 2009 relative to 2008, and the profit increased. Simple break-even analyses were conducted to determine the cost per calf in 2008 that would have been necessary to achieve a return to labor and management equal to that in 2009, holding all other variables equal. Since it was determined that a profit of $99.11 could be realized in a 70-day preconditioning period in this herd, the question became, "What changes could have been made in 2008 to realize the same profit of $99.11 achieved in 2009?" If the cost per calf was decreased from $115.00 to $74.54, the producer would have achieved a return of $99.11 per head. Calculated another way, if the additional gross revenue was $214.11 per calf due to preconditioning instead of the actual figure of $185.49, it would have also enabled a return of $99.11 in 2008. This illustration shows that decreasing costs and/or adding additional gross revenue are both effective ways to improve overall profitability of a preconditioning enterprise. Seemingly small differences in costs between 2008 and 2009 drove significant differences in returns, and solving for the input and output prices which would have allowed equal performance provided a framework to compare performance in a meaningful way.

Table 3. Ration changes in Indiana test herd from 1999–2001.

Rations on *as fed* basis		
		Days 1-48
Ingredient	1999	amount fed/day (lb)
Corn		4.5
Protein supplement		1.25
Fescue hay		11.6
Performance		
Average daily gain (ADG)		1.21 (lb)
Feed cost of gain		$48.93/cwt
		Days 1-49
Ingredient	2000	amount fed/day (lb)
Corn		3.5
Soybean hulls		8
Protein supplement		0.5
Mixed hay		2.5
Performance		
ADG		1.47 (lb)
Feed cost of gain		$45.21/cwt
		Days 1-30
Ingredient	2001	amount fed/day (lb)
Corn		3
Corn gluten		7
Mixed hay		3
Limestone		0.1
		Days 31-46
Ingredient		amount fed/day (lb)
Corn		3
Corn gluten		7.5
Mixed hay		2.5
Limestone		0.1
Performance		
ADG		1.91 (lb)
Feed cost of gain		$32.10/cwt

Several questions surrounding increased days-on-feed were asked by the participating herd owner. An analysis of the data from this study found that return to labor and management increased with additional days fed within the preconditioning period considered. Figure 3 shows the trend in days fed and the return to management and labor per calf from 1999 to 2009. The owner increased days fed from 46 in 1999 to 70 in 2008 and 2009.

Table 5 shows the 2009 ration and demonstrates progress from the first rations in 1999 to 2001 (Table 3). Rations are updated each year based on commodity prices and goals of the owner and buyer. It should be noted that others have outlined nutritional programs that use high quality pasture as the cornerstone of the preconditioning nutrition.[13,17] While this can be a good option in many areas of the country, it was not feasible for this herd, which grazed mostly KY-31 endophyte-infected fescue pasture and weaned in late August or early September, when pasture quality and quantity were poor.

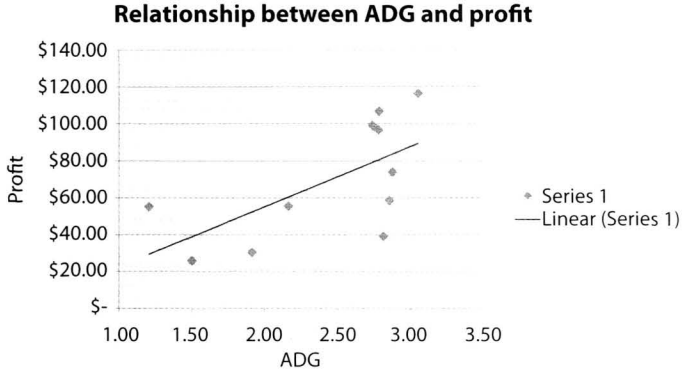

Figure 2. Relationship between average daily gain (ADG) and profit for calves preconditioned in an Indiana beef herd. The average daily gain and profit from individual years included in the data set are treated as individual observations, although it is acknowledged that each observation is actually profit and ADG from the same farm in a different year. Time trends, changing prices, and relative costs of production are not accounted for in this graphical analysis for simplicity.

Health

Many preconditioning trials and simulations consider mortality rates at levels that make cow-calf producers hesitate to precondition their calves. Producers that have never preconditioned calves may be unfamiliar with early signs of bovine respiratory disease (BRD), and feel that sickness and death loss could eliminate profits due to preconditioning. In our test herd, the morbidity rate over 11 years was 0.09% (1 of 1,103) and the mortality rate was 0.27% (3 of 1,103). The single morbidity was a calf with bloat that resolved with conventional treatment, and the three deaths were due to an accident, a chronically poor-doer since birth, and a chronic BRD case. One other calf died two days after being sold, and the cow-calf producer refunded the money for this calf. Overall morbidity and mortality have been extremely minor factors in profitability in this herd during preconditioning. The successful health outcomes of the IQ+BEEF calves in this herd have been credited to a proven vaccination protocol devised by the owner's herd health veterinarian, a pre-weaning adaption program, an adequate preconditioning environment (drylot with plenty of shade, space, water, and bunk space), and a balanced ration.

Genetics

The genetics of this herd have changed substantially since 1999. The herd owner has a history of purchasing bulls from the Indiana Beef Evaluation

Table 4. Comparison of 2008 and 2009 performance and break-even analyses for calves preconditioned in the study beef herd.

	Actual data		Break-even analyses	
			↓ cost scenario	↑ revenue scenario
Year	2008	2009	2008	2008
Average daily gain, lb	2.86	2.74	2.86	2.86
Days fed	70	70	70	70
Cost of gain, $/lb	$0.57	$0.45	$0.57	$0.57
Feed cost of gain, $/lb	$0.47	$0.36	$0.47	$0.47
Health cost/calf	$13.62	$10.41	$13.62	$13.62
Additional gross revenue/calf*	$173.65	$185.49	$173.65	$214.11
Costs/calf	$115.00	$86.38	$74.54	$115.00
Return to labor and management/calf	$58.65	$99.11	$99.11	$99.11

*Additional gross revenue/calf is value of calf sold after preconditioning less the value of calf the day of weaning.

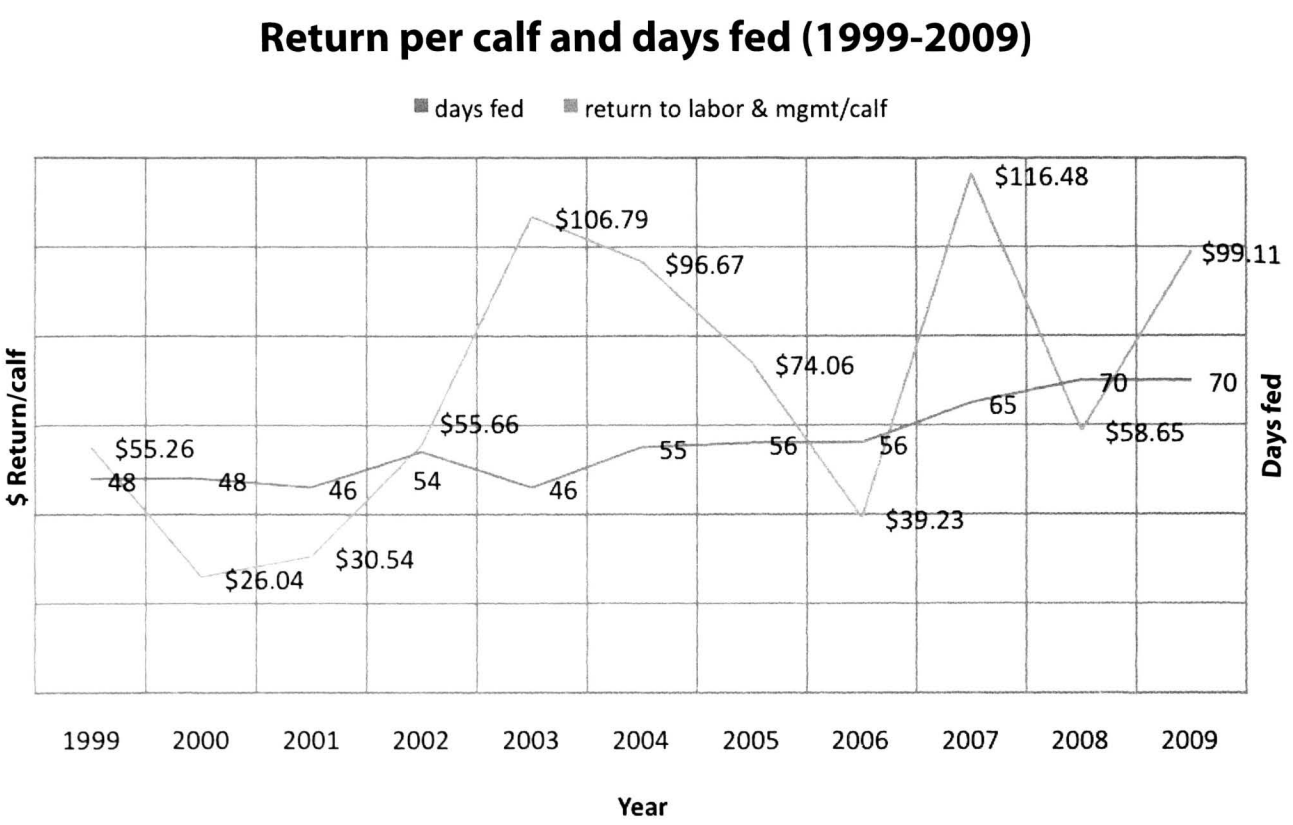

Figure 3. The relationship of economic return per calf and days fed in calves preconditioned in an Indiana beef herd (1999–2009).

Program (IBEP). This test station has an excellent reputation in the midwest, and is a source for high quality bulls throughout the area. While this was an excellent venue to purchase bulls, the owner needed to learn more about genetics and Expected Progeny Differences (EPDs) to improve his herd. Breed was not a significant factor in his bull purchasing decisions, and in 1998 his bull battery consisted of two Angus, one Hereford, one Limousin, and one Gelbvieh bull. Bulls were placed in small, single-bull breeding pastures with little regard to genetic mix of cows. The herd owner was advised to keep daughters of the Limousin bull because an adviser was of the opinion that the Limousin was the best of his bulls to sire replacement females. When the owner was asked his number one herd goal, it was to improve herd fertility. His pregnancy percentage in 1998 was 82.03%, and in 1999 it was 75.86%. His calving season stretched for about 150 days. It was the opinion of the Purdue Beef IRM team that the owner needed additional sources of advice on herd genetics because, according to research at the US Meat Animal Research Center, Limousin-sired females of all ages were significantly less likely to be pregnant compared to all other crosses except Hereford, which were no different from Limousin.[11] It should be noted that since then the Limousin breed has made substantial strides in improving breed fertility. The EPDs for stayability and scrotal circumference, which are indirect measurements for fertility, have steadily improved since 1992 when then bull in question was born.[19]

In 1999 the team examined the herd genetics and determined that the average cow was 65% Angus. In an attempt to better match the cows to the sires currently owned, it was suggested that cows that were one-half or more Angus should be placed with the Gelbvieh or Limousin bull. If a cow had one-quarter or more Continental blood, the team recommended mating with the Hereford or one of the Angus bulls. The oldest bull of the group was the Limousin, and he had sired 133 calves that had an average weaning weight ratio of 96. When the sire summary report was run on his herd records, the Limousin was shown to be the poorest bull of the group, and the team advised sending him to slaughter. The owner agreed and the bull was sold. These genetic changes allowed the owner to improve weaning weight and ADG during preconditioning so that overall profitability could be improved.

Color was also determined to be a driver in calf price. The owner had placed all red cows with the Black Angus bulls. All black cows were placed with the

Table 5. Ration utilized during the preconditioning period in the Indiana beef test herd in 2009.

Feedstuff	Week 1 475 lb	Week 2 490 lb	Week 3 507 lb	Week 4 525 lb	Week 5 544 lb	Week 6 564 lb	Week 7 585 lb	Week 8 609 lb	Week 9 635 lb
Corn gluten	3.25	3.4	3.8	4	4.3	3.6	4	4.5	4.9
Soy hulls	2.5	2.5	2.5	2.5	3	3.25	3.2	3.23	3.2
Cracked corn	3	3.5	4.25	4.8	5.25	6.5	7.8	8.7	9.5
Hay – square	3.5	3.5	–	–	–	–	–	–	–
Hay – round	–	–	3	3	2.5	2.5	2.5	2.5	2.5
Gluten balancer	0.27	0.3	0.25	0.27	0.28	0.3	0.33	0.35	0.38
Limestone	–	–	0.05	0.06	0.08	0.05	0.07	0.09	0.11
% consumption*	95	101	102	106	109	112	120	126	130
Ca:P	2.14	2.06	2	2.03	2.05	2.01	2.02	2	2.04
Projected average daily gain, lb	2.09	2.42	2.55	2.74	2.92	3.11	3.51	3.78	3.96
Crude protein	14.9	14.5	14.5	14.5	14.4	13.5	13.5	13.6	13.7
Cost/head/day ($)	0.73	0.78	0.82	0.88	0.94	0.97	1.09	1.19	1.28
Cost/lb of gain ($)	0.41	0.38	0.38	0.38	0.38	0.37	0.36	0.36	0.36

*% consumption = actual consumption as a percent of bodyweight compared to computer estimates. High health, high genetic calves consumed more ration than projected.

remaining bulls (all were red). Many of the red cows were purebred Red Angus or Red Angus x Red Poll. In the initial preconditioning sale, red calves sold at an average of $3 per cwt discount to black, black-baldy (black with white face) or brown calves. With the test herd calves averaging 501 lb (227 kg) at the sale, a red calf would be discounted approximately $15.03 per calf. The team explained that, especially with the purebred Red Angus cows, he was producing a calf with no hybrid vigor and likely giving up about 8.5% of weaning weight with these calves.[7] In 1999, actual weaning weight of calves averaged 443 lb (201 kg) so purebred calves were estimated to have been 38 lb (17.2 kg) lighter than a similar crossbred calf would have been. This was a lost opportunity of $31 per head with calves selling at $82.66 per cwt. The owner quickly realized the loss of saleable pounds due to lack of heterosis were worth double the "bonus" he received due to hide color. The following year the red Gelbvieh bull was mated to all the Red Angus and Red Angus x Red Poll cows so that heterosis could be improved.

Over the next years the owner continued to buy higher quality bulls at IBEP and through private treaty, purchasing Angus, Gelbvieh, Balancer®, and SimAngus bulls for his herd. Bulls were allocated to cows based on genetic makeup with the goal of producing calves that were 25-50% Continental and 50-75% British genetics. Before our involvement in herd genetic consultation, herd average weaning weight from 1995 to 1998 was 457 lb (207 kg) with an adjusted average weaning weight of 462 lb (210 kg). Those same averages from 2003 to 2009 were 478 lb (217 kg) and 523 lb (237 kg), respectively. While all the additional weaning weight gain cannot be attributed to genetics, genetic improvement made a considerable difference.

Technology

The private practice, herd health veterinarians and the Indiana IRM team worked together to assist the herd owner in utilizing improved technology in this herd. Notable improvements included the use of nursing calf and weaning-time growth implants for all calves, an ionophore in the preconditioning ration, feed analysis of hay and by-product feeds, greater utilization of EPDs in sire selection, improved hybrid vigor by purchasing crossbred females, and purchasing high quality bulls that complimented cow-herd genetics. In 2006 through 2009, all calves were purchased by a feedlot owner that sells an "all-natural" branded beef product, so implant and ionophore technology use was discontinued in 2006.

Marketing

When the IQ+BEEF program was started in 1999, a specialized sale was organized where only IQ+BEEF calves would be sold. A total of 372 calves sold at the initial sale and, although this was short of the goal of 500 calves, most participants felt positive about the prices received. The test herd returned an additional $55.26 per head.

The herd owner's 80 steers and heifers were purchased by three different family-owned feedlots in Indiana.

The following year the special sale was not as successful. Approximately 550 calves had been consigned to the sale, but only 308 were delivered. Nearly half the consigned calves had been sold prior to the sale, with most selling through private treaty to feedlots that purchased them the previous year. The test herd owner was also called before the sale by one of his buyers from the previous year. However, he opted to support the special sale as he knew it was important to have sufficient calf numbers for the sale to be successful. His calves ultimately sold for less than he was offered before the sale. He still made a profit, but only $26.04 per calf, or $2,395.38 for 92 head. It should be noted that the calves sold at a lower price per cwt than the reference calves from the Kentucky sales, but due to weight gain, a modest economic return was still achieved.

The special IQ+BEEF sale was cancelled in 2001 due to low numbers of cattle consigned and the presumption by sellers without adequate production records that there was an inadequate premium due to preconditioning. To many sellers and buyers, the IQ+BEEF Program had not been as successful as anticipated. However, owners that sold their calves privately or at the sale at an added profit, and owners that knew their actual costs of preconditioning, knew the program was a success. The goal of the IQ+BEEF program was to add value to calves in Indiana herds, and in that respect it was an unequivocal success.

Conclusion

Many factors are associated with achieving success in a preconditioning program. This analysis highlights some of the key determinants of success in developing a preconditioning program. Veterinarians should consider these multiple factors, and the interactions among them, when facilitating the development of a successful preconditioning program.

This analysis did not focus on the preconditioning bonus, but rather on factors under the direct control of the owner, such as genetics, health, feed cost, marketing options, and growth. Returns to preconditioning were found to come largely from efficiently gaining additional weight, rather than a bonus or premium for preconditioning. If ADG of 2.5 to 3 lb (1.13 to 1.36 kg) per head per day can be achieved in calves without getting them overly "fleshy", the economics of preconditioning will be greatly enhanced. Beyond pounds of gain alone, the cost of gain is vitally important in preconditioning profitability.

The herd owner analyzed in this assessment spent multiple years developing managerial skills to successfully incorporate preconditioning into the farm operation. Utilizing a team of experts to assess factors contributing indirectly to the success of a preconditioning program was important for the farm analyzed. Improvements in ration balancing, health, and genetics all played a role in the increased performance of this herd over time. The herd's poor reproductive concerns were also addressed, and pregnancy rate averaged 88.7% from 2003 to 2009. The herd also shortened the calving season, and 96.9% of calves were born by day 63 of the calving season during this same time period, compared to only 78.9% in 1998.

A vital part of this assessment was good record keeping by the farm operator. Assessing cost and return per calf on an annual basis, and for the preconditioning enterprise specifically, allowed in-depth profitability analyses and aided the farm in determining break-even assessment and where the returns to preconditioning were originating – whether through additional weight gain or through bonuses or premiums.

An acknowledged limitation of this study is that it analyzed a single herd. Opportunities for future research exist in continuing assessments of preconditioning in additional herds. This assessment serves as an example case study, but future research goals include collection of data on additional herds. Of particular interest in the future is assessment of a herd that uses pasture as the main component of the preconditioning diet so that the economic viability of a pasture preconditioning program may be determined. While it is beyond the scope of this paper, it would be ideal to have collected gain, health, and profitability data on the calves after they entered the feedlot moving forward to facilitate more complete assessments. Our analysis of 11 years of data from a single case study herd has shown that preconditioning can be profitable, and that success in preconditioning tended to increase as the owner gained experience in managing the process.

Endnotes

[a]Bovi-Shield® 4 or Bovi-Shield® Gold 5, Pfizer Animal Health, New York, NY

[b]Ralgro® or Synovex® S/Synovex® H, Intervet/Schering-Plough Animal Health, De Soto, KS and Fort Dodge Animal Health, Overland Park, KS, respectively

[c]UltraChoice™ 7 or Vision® 7 w/Spur®, Pfizer Animal Health, New York, NY and Intervet/Schering-Plough Animal Health, De Soto, KS, respectively

[d]Ivomec®, Dectomax®, or Cydectin®, Merial Limited, Duluth, GA, Pfizer Animal Health, New York, NY, and Fort Dodge Animal Health, Overland Park, KS, respectively

[e]Pulmoguard® PHM, Boehringer Ingelheim Vet Medica, St. Joseph, MO

[f]PU Beef, Purdue University Cooperative Extension Service, and BRaNDS, Iowa State University Cooperative Extension Service

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CONTRAINDICATIONS:
Do not use in animals showing hypersensitivity to either flunixin meglumine or oxytetracycline.

WARNINGS AND PRECAUTIONS:
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Residue Warnings: Discontinue treatment at least 21 days prior to slaughter of cattle. Do not use in female dairy cattle 20 months of age or older. Use in this class of cattle may cause milk residues. A withdrawal period has not been established for this product in pre-ruminating calves. Do not use in calves to be processed for veal. Use of dosages other than those indicated may result in residue violations.

Exceeding the highest recommended level of drug per pound of bodyweight per day, administering more than the recommended number of treatments, and/or exceeding 10 mL intramuscularly or subcutaneously per injection site in beef cattle and non-lactating dairy cattle may result in antibiotic residues beyond the withdrawal time.

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At the first sign of any adverse reaction, discontinue use of the product. Some of the reactions may be attributable either to anaphylaxis (an allergic reaction) or to cardiovascular collapse of unknown cause. Shortly after injection, treated animals may have transient hemoglobinuria resulting in darkened urine. Intramuscular injection in the rump area may cause mild temporary lameness associated with swelling at the injection site. Flunixin is a cyclo-oxygenase inhibitory NSAID, and as with others in this class, adverse effects may occur with its use. The most frequently reported adverse effects have been gastrointestinal signs. Events involving suspected renal, hematologic, neurologic, dermatologic, and hepatic effects have also been reported for other drugs in this class.

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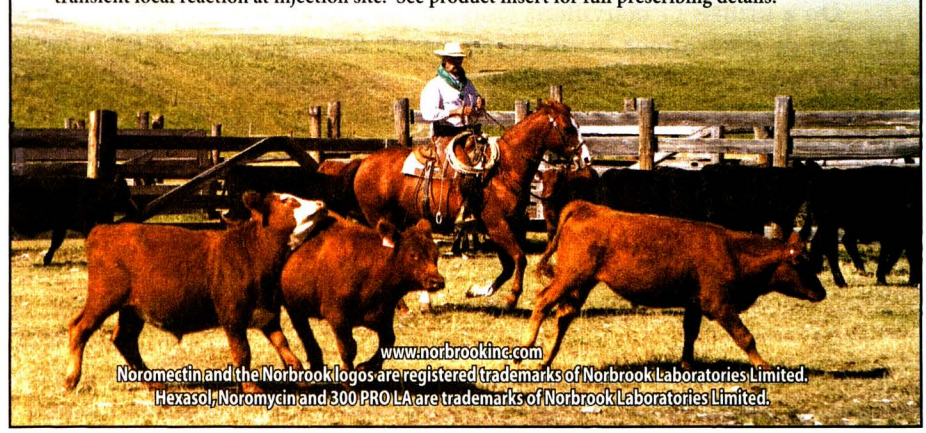

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