Preconditioning Beef Calves

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INTRODUCTION

In the beef industry, "preconditioning" generally refers to management practices implemented around weaning that are intended to optimize the immune system and nutritional status of calves while minimizing stress. Conventional preconditioning programs include vaccination against clostridial and respiratory diseases, parasite control, castration, and dehorning. These programs also commonly include weaning calves at least three weeks prior to shipping and training calves to eat from a feed bunk and drink from a trough. Cole (1985) reviewed experiments comparing preconditioned to non-preconditioned calves and reported little difference in performance when calves were evaluated over the entire feeding period, but found morbidity and mortality rates were lower for calves that were preconditioned.

During the last 20 years, due to the advent of "Value Added Calf" programs, preconditioning has evolved into more rigid vaccination and management protocols. However, a single preconditioning management protocol may not fit all management systems, cattle types, or market environments. Producers preconditioning calves prior to shipping are challenged to identify practical preconditioning approaches that can be implemented within their management system and yield sufficient price premiums to be cost-effective.

The objective of this paper is to discuss preconditioning approaches, the impact of preconditioning on subsequent performance, and the cost-effectiveness of preconditioning calves.

VALUE ADDED CALF PROGRAMS

In the 1990s, Extension Specialists at Texas A&M University developed a set of standardized calf health management protocols to guide producers in adding value to calves. The Value Added Calf (VAC) guidelines were created based partly upon observations of calf performance in the Texas Ranch to Rail program. Table 1 lists the VAC guidelines for raised calves. The VAC-PreWean and VAC-PreWean Plus programs were designed for operations that ship calves at weaning. The VAC-45 PreWean and VAC-45 Weaning options are preferred over the VAC-PreWean and VAC-PreWean Plus programs because the VAC-45 options separate weaning and shipping by a minimum of 45 days. Since weaning and shipping are both stressful events in a calf's life, the time lapse between weaning and shipping is important. By separating these stressors, the immunosuppressive impacts of each event are not combined, which reduces overall stress. Therefore, separating weaning and shipping, when combined with a sound vaccination protocol, further enhances the value of calves and is rewarded in the marketplace.

In conventional preconditioning programs, less than 30 days generally separate weaning and shipping. The 45-day requirement for VAC-45 programs was established because health records from Texas Ranch to Rail calves indicated that calves entering the feedlot within 14 days after weaning, and from 31 to 45 days after weaning, had medicine costs four-fold and two-fold greater, respectively, than calves entering the feedlot more than 45 days after weaning. Data from the New Mexico Ranch to Rail program also support extending the separation of weaning and shipping beyond 30 days, showing that steers weaned 41 days or more before entering a feedlot generated greater net income during finishing than steers weaned 21 to 40 days prior to shipping or less than 20 days prior to shipping (Figure 1).

Premiums for Value-Added Calves

The VAC guidelines have served as a foundation for numerous "certified" preconditioning programs. In fact, price premiums for VAC-45 and VAC-34 (Superior Livestock's version of VAC-PreWean Plus) calves marketed through Superior Livestock video auction sales increased from 2000 to 2004. In 2000, annual

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Table 1. Value Added Calf (VAC) Vaccination Program Guidelines[a]

Program	2–4 months old[b] "Branding"	4–6 weeks[b] Pre-weaning	Weaning	2–3 weeks Post-weaning
VAC-PreWean	MLV Respiratory[c] Clostridial 7-way		Ship	
VAC-PreWean Plus		MLV Respiratory Clostridial 7-way	Ship	
VAC-45[d] *Pre-Weaning Option*	Initial vaccination given at branding *or* pre-weaning	MLV Respiratory Clostridial 7-way	MLV Respiratory Clostridial 7-way	
VAC-45[d] *Weaning Option*			MLV Respiratory Clostridial 7-way	MLV Respiratory Clostridial 7-way

[a] Complete description of VAC Guidelines is available at http://animalscience.tamu.edu/ansc/publications/rrpubs/vac_vaccine.pdf
[b] A bovine veterinarian should be consulted for guidance on the use of MLV vaccines in nursing calves.
[c] MLV Respiratory = Modified Live Virus vaccine for IBR, PI3, BRSV, BVD; a combination vaccine may be acceptable.
[d] Calves are not shipped until ≥ 45 days post-weaning.

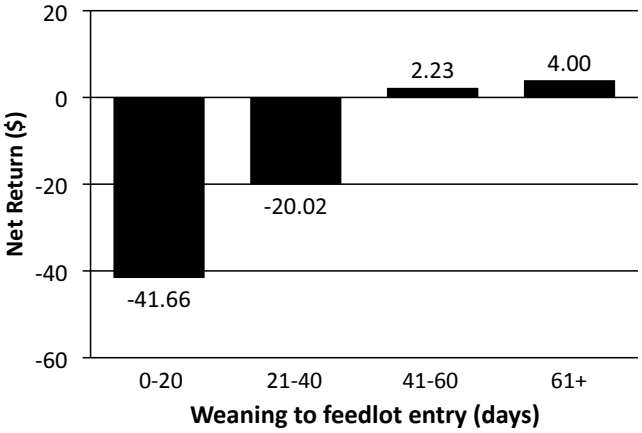

***Figure 1*. Impact of time from weaning to feedlot entry on net return of steers in the New Mexico Ranch to Rail program from 2001–2004 (Waggoner et al., 2005).**

average price premiums ranged from $3.66 to $7.91/cwt for VAC-45 calves, and from $1.76 to $3.47/cwt for VAC-34 calves. Since 2004, average price premiums for VAC-45 calves have remained between $6.50 and $8.00/cwt; for VAC-34 calves they have ranged from $2.45 to $4.68/cwt. Calves marketed as VAC-45 and VAC-34 made up about 25% and 50%, respectively, of calves sold through Superior Livestock video auctions in 2007.

IMPACT OF PRECONDITIONING ON SUBSEQUENT PERFORMANCE

Research on the impact of preconditioning on subsequent performance has yielded varying results, which makes it difficult to identify a consistent and reliable effect of preconditioning. This variation among studies may be due to the length of time cattle were preconditioned, and to differences in cattle genetics and prior management.

A researcher in Texas compared the performance of preconditioned to non-preconditioned calves and found little difference in average daily gain (ADG) or feed-to-gain ratio (feed:gain) over the entire feeding period; morbidity and mortality were 6.1 and 0.7 percentage units lower, respectively, for preconditioned than non-preconditioned calves (Cole, 1985). In a controlled experiment in South Dakota, Pritchard and Mendez (1990) randomly assigned calves from the same source to treatments so that the source of cattle did not confound the results. They then evaluated the effects of preconditioning on post-shipping performance. They found that, although preconditioned calves had a slightly lower ratio of feed to gain (Table 2), there was no difference in cumulative feedlot ADG or days on feed, nor were there differences in morbidity and death loss attributable to pre-shipping management (Table 3). They concluded that performance differences between preconditioned and non-preconditioned calves were lost if calves were fed for more than 56 days, and that the 25- to 30-day preconditioning program employed did not improve beef production efficiency.

Results of other studies have revealed substantial positive impacts of preconditioning on subsequent performance; however, it must be noted that in these studies preconditioning is completely confounded with source. Thus, it is not possible to fully separate the impact of preconditioning from that of other management or genetic differences among sources of calves.

Researchers in Colorado compared feedlot performance and end product characteristics of two groups of calves purchased from a certified preconditioning program (≥ 30 days weaned) to calves with no known history (Roeber et al., 2001). The study revealed that the "certified preconditioned" calves had a 0.22-lb ADG advantage during the finishing period, and had a 42.6 and 10.3 percentage unit lower morbidity and death loss,

Table 2. Impact of Preconditioning on Cumulative Finishing Period Performance

	Preconditioned	Non-Preconditioned
South Dakota; Pritchard and Mendez, 1990[a]		
ADG, lbs	3.02	3.06
Feed:Gain	6.44	6.24
Days on Feed	242	243
Colorado; Roeber et al., 2001[b]		
ADG, lbs	3.55	3.73
Texas; Cravey, 1996[c]		
ADG, lbs	2.88	2.59
Feed:Gain	5.98	6.45
Days on Feed	205	217

[a] Data from Exp. II (4 ranches, 2 yrs); Preconditioned calves were vaccinated against respiratory and clostridial diseases and dewormed 3 weeks pre-weaning, and 25–30 days prior to shipping were weaned and fed a commercial pellet + grass hay. Non-Preconditioned calves were weaned and shipped.

[b] Preconditioned = Certified Preconditioned for Health (weaned ≥ 30 days prior to shipping); Non-Preconditioned = no previous history.

[c] Preconditioned = Hi-Pro Producer's Edge Program (weaned 45–50 days prior to shipping and vaccinated twice with MLV respiratory and *P. haemolytica* vaccine); Non-Preconditioned = feedyard started.

respectively, than calves of unknown history. However, there was no difference in marbling score, yield grade, or palatability traits of beef when compared between preconditioned and non-preconditioned calves.

Very few reports evaluating calves preconditioned for 45 days or more are available. A researcher in Texas compared feedyard closeouts from 1,685 calves preconditioned for 45 to 50 days according to the Hi-Pro Producer's Edge protocol of the 1990s to closeouts from lots totaling 1,492 head of feedyard-started (non-preconditioned) calves. Preconditioned calves had a 0.29-lb ADG advantage and 7.2% better feed efficiency, coupled with $29.47/hd lower medicine cost and a 3.1 percentage unit lower death loss (Cravey, 1996). An Oklahoma State University study lends further credit to the value of preconditioning calves for 45 days or more. Oklahoma State University scientists reported that calves preconditioned according to Oklahoma Quality Beef Network guidelines had a 22.4 and 2.9 percentage unit lower morbidity and death loss, respectively, than similar calves with little or no health management history (Lalman et al., 2005)

These studies represent a wide variation in preconditioning systems, from differences in vaccination protocols to nutritional management approaches. Therefore, there is no consistent cumulative post-shipping ADG, feed conversion, or days-on-feed advantage attributable to preconditioning. Other than the work conducted in South Dakota, all studies included in Table 3 indicated a marked benefit from preconditioning in reducing morbidity and death loss.

PRECONDITIONING APPROACHES

Producers must define their objectives before implementing a post-weaning management program. For example, a producer may precondition calves with the intent of selling for a premium immediately after preconditioning; the main interest would then be in low-cost gain. On the other hand, a producer may retain ownership of calves and choose to precondition them for the purpose of optimizing calf health to improve overall performance and profit through harvest; in this case, the producer is less interested in weight gain during preconditioning. The preconditioning approach may be vastly different in these two scenarios.

Pasture-based preconditioning programs are generally perceived to be less stressful than drylot programs because the environmental change from pre-weaning to post-weaning is minimal. However, it is common for calves to be confined to a drylot and fed a forage- or concentrate-based preconditioning ration for the entire preconditioning period. Some trade-offs between preconditioning management approaches exist.

Pasture Preconditinoing
+ less environmental change
+ less dietary change
+ less dust or mud control is required
+ lower cost
– often less gain
– often not trained to eat from a bunk

Drylot Preconditioning
+ often more gain
+ trained to eat from a bunk
– greater environmental change
– more dust or mud control is needed
– greater feed cost

A study conducted at New Mexico State University compared a low-input pasture preconditioning approach to a high-input drylot preconditioning approach. Performance and profit were evaluated during the preconditioning and finishing phases (Mathis et al., 2008).

Table 3. Impact of Preconditioning on Subsequent Health

	Preconditioned	Non-Preconditioned
South Dakota; Pritchard and Mendez, 1990[a]		
Morbidity, % (Exp. I)	21	19
Morbidity, % (Exp. II)	45	47
Colorado; Roeber et al., 2001[b]		
Morbidity, %	35	77
Death Loss, %	1.1	11.4
Texas; Cravey, 1996[c]		
Medicine Cost, $/hd	13.74	30.66
Death Loss, %	0.5	2.6
Oklahoma; Lalman et al., 2005[d]		
Morbidity, %	7	29
Death Loss, %	0.1	3.0

[a] Preconditioned calves were vaccinated against respiratory and clostridial diseases and dewormed 3 weeks preweaning, and 25–30 days prior to shipping were weaned and fed a commercial pellet + grass hay. Non-Preconditioned calves were weaned and shipped.
[b] Preconditioned = Certified Preconditioned for Health (weaned ≥ 30 days prior to shipping); Non-Preconditioned = no previous history.
[c] Preconditioned = Hi-Pro Producer's Edge Program (weaned 45–50 days prior to shipping); Non-Preconditioned = feedyard started.
[d] Preconditioned = Oklahoma Quality Beef Network-certified (weaned ≥ 45 days prior to shipping); Non-Preconditioned = little or no health management history; morbidity and death loss values for 90 days post-shipping.

Treatments were 1) high-input drylot preconditioning system (corn/wheat midds-based pellet plus 1.5–2.5 lb/day of alfalfa hay) or 2) low-input pasture preconditioning system (native range pasture plus 1.25 lb/day of a 32% CP range cube delivered 3 times weekly). All calves qualified as VAC-45. After preconditioning, all steers were fed at a commercial feedlot, then sold on an individual carcass basis.

During the preconditioning phase, the drylot preconditioned calves gained 0.32 lb/day more and were worth an additional $6.90/hd (Table 4). The higher value of the drylot calves was offset by $52.76 greater cost per calf for drylot preconditioning. Consequently, net income during preconditioning was $44.59/hd greater for pasture preconditioned calves even though they gained less weight than the drylot preconditioned calves. These results support the findings of a study conducted in Mississippi that showed lower feed cost and greater net return ($43.17/hd) for a 30-day ryegrass pasture preconditioning program compared to a higher input 30-day drylot preconditioning program (St. Louis et al., 2003).

During the finishing phase, the study conducted by Mathis et al. (2008) revealed no differences in overall feedlot ADG, finished body weight, days on feed (DOF), or any measured carcass characteristics. There was a tendency for drylot preconditioned steers to have more sickness than pasture preconditioned steers (48% vs. 34%). The drylot preconditioned steers also had greater death loss (7.6% vs. 0%). During finishing, the pasture preconditioned steers profited $103/hd more than the drylot preconditioned steers. The authors suggested that the additional stressors of greater dietary and environmental change experienced by drylot-preconditioned calves during the 45-day preconditioning phase possibly yielded a long-term susceptibility that rendered the drylot-preconditioned steers less competent than the pasture-preconditioned steers to withstand immune challenges during the finishing phase.

A study in Ohio compared health performance of calves that were 1) shipped at weaning, 2) preconditioned for 30 days on pasture (fescue pasture + supplement) with fenceline contact with their dams for the first 7 days, and 3) preconditioned for 30 days in a drylot (hay + supplement) with no contact with dams (Boyles et al., 2007). During the following 28-day receiving period, 15% of the pasture-preconditioned/fenceline-weaned calves were treated for sickness, whereas 28% of calves shipped at weaning and 38% of calves preconditioned in a drylot were treated for sickness. The fenceline-weaning, pasture-based preconditioning approach better prepared calves to withstand the immune challenges they faced during the feedlot receiving period, yet weaning calves for 30 days in a drylot provided no benefit in reducing morbidity compared to shipping calves at weaning.

There are differences of opinion in the industry regarding how calves should be managed between weaning and shipping. It is also clear that management approaches that work well for some calves may not be the best approach for calves from a different source, management system, or region. However, there is mounting scientific evidence that managing calves on pasture between weaning and shipping may render calves more competent to withstand subsequent immune challenges.

Table 4. Impact of Preconditioning System on Performance and Profit During the Preconditioning and Finishing Phases[a]

Item	Drylot Preconditioning	Pasture Preconditioning
Preconditioning Phase		
# of Head	125	125
ADG, lbs	1.42	1.10
Total Cost, $	66.77	14.01
Net Income[b], $	–28.87	15.72
Finishing Phase		
# of Steers	66	67
ADG, lbs	2.93	2.98
Days on Feed	168	173
Treated for Sickness, %	47.6	34.3
Death Loss, %	7.6	0.0
Net Income, $	–98.33	4.68

[a] Source: Mathis et al., 2008.
[b] Price premium for VAC-45 was not included in the analysis.

COST VS. PREMIUMS FOR PRECONDITIONING

There is no universally accepted best approach to preconditioning calves, even though there is evidence that some approaches better prepare calves for the challenges of shipping and commingling. Ultimately, managers considering preconditioning calves prior to shipping must weigh the cost of implementing the preconditioning program against the additional value that will be garnered by the preconditioned calves.

The component that prevents most producers from preconditioning is holding the calves for 30 to 45 days after weaning, which likely explains why there are approximately twice as many VAC-34 as VAC-45 calves sold through Superior Livestock's video auction. The VAC-34, or similar VAC-PreWean Plus, is considered by some to be the best of the defined health programs available for calves that are shipped at weaning. Since separating weaning and shipping by 45 days or more is preferred, it is logical to evaluate the cost-effectiveness of preconditioning by comparing a VAC-45 preconditioning program with the more commonly implemented VAC-34 health program that requires substantially less input. During the post-weaning portion of a VAC-45 preconditioning program, targeted ADG typically ranges from 1.0 to 3.0 lb/day, depending on the level of nutritional input. Because performance can be programmed at different rates, and feed commodity and calf prices significantly impact costs and returns, the relationship between calf performance and the value of additional gain is important in determining the optimal level of input and the potential for profit of the preconditioning enterprise.

Illustrated in Figure 2 is the calculated value addition of VAC-45 preconditioned calves above that of VAC-34 calves at three rates of ADG during the 45-day post-weaning period. The increase in gross value was calculated using a 550-lb weaned calf weight valued at $120/cwt as a base ($660/hd). Prices at different weights were calculated using three-year average price premiums for VAC-34 ($3.51/cwt) and VAC-45 ($7.36/cwt) sold through Superior Livestock's video auction, and a $6.50/cwt price slide. Under these assumptions, a VAC-45 program with calves gaining 1.0 lb/day would be cost-effective if the cost of VAC-45 preconditioning is not more than $61/hd ($740–$679/hd) over VAC-34 costs. If the calves gained 3.0 lb/day during the 45-day period, then additional costs would need to remain below $133/hd ($812–$679/hd).

The difference in gross value in these comparisons is primarily a function of weight gain, not of the VAC-45 price premium. Increasing rate of gain during preconditioning considerably increases gross value, but the marginal value of the additional gain declines as rate of gain increases (Figure 3). In fact, employing the same assumptions used in Figure 2, the calculated marginal value of gain during a VAC-45 preconditioning program is 33–45% greater for 1.0 lb than 3.0 lb ADG, depending upon the 550-lb calf base price.

The research trials conducted in New Mexico (Mathis et al., 2008) and Ohio (Boyles et al., 2007) both reported lower comparative costs when calves were preconditioned in pasture-based systems than in a drylot. This is not to suggest that drylot preconditioning programs cannot be cost-effective; rather, when considering current grain and hay prices, the input costs of drylot-based preconditioning programs should be evaluated closely relative to projected performance during preconditioning.

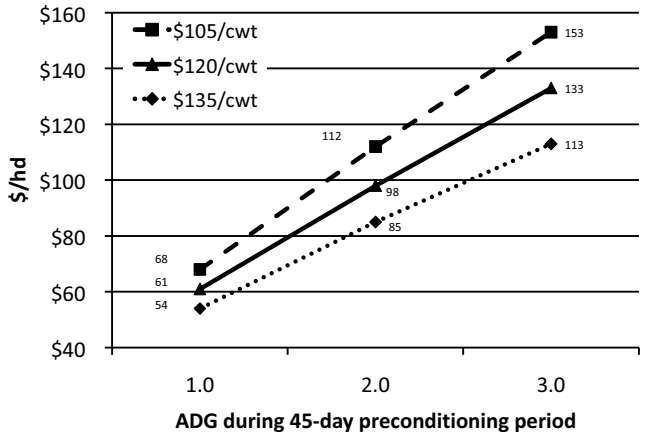

***Figure 2*. Value addition from VAC-45 above VAC-34 at three preconditioning rates of ADG and base weaning prices of $105, $120, and $135/cwt.**

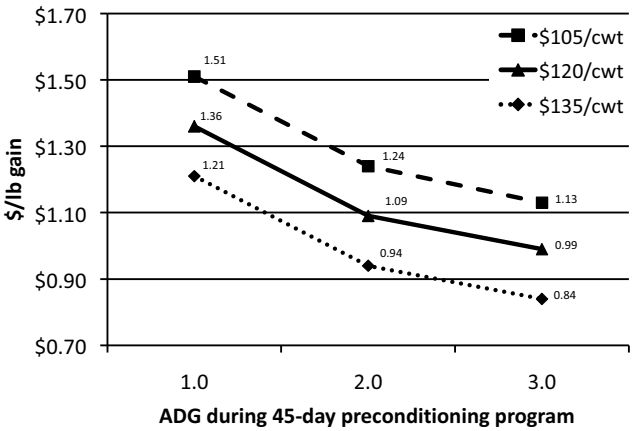

Figure 3. **Marginal value of additional gain from VAC-45 above VAC-34 at three 45-day preconditioning rates of ADG and base weaning prices of $105, $120, and $135/cwt.**

CONCLUSIONS

Even though "preconditioning" remains without strict definition in the beef industry, efforts like the development of the Value Added Calf guidelines have led to increased uniformity in practices that prepare calves for the challenges they will face once they leave their ranch of origin. The primary value of preconditioning programs to the cattle industry is in reducing the risk of subsequent sickness in calves. Preconditioning practices are justified and rewarded in the marketplace; however, the premium received for preconditioned calves may not always offset the cost of preconditioning. In the current era of higher feed prices, cost-effective preconditioning of calves on the farm or ranch of origin will likely focus on minimizing costs ahead of adding weight during the preconditioning process.

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