Preconditioning Beef Calves: Are Expected Premiums Sufficient to Justify the Practice?

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The author would like to acknowledge Jody Holthaus and David Hallauer for collecting data that was used for a portion of this analysis.

Selected Paper prepared for presentation at the Western Agricultural Economics Association Annual Meeting, Honolulu, Hawaii, June 30-July 2, 2004.

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Abstract

The concept of preconditioning calves has been around for a long time, yet adoption of the practice has been slow. Current trends in the beef industry likely will increase interest in preconditioning programs. This research estimates premiums received for preconditioned calves and the expected returns from a preconditioning program. Preconditioned calves sold in the fall received a premium of approximately $4.50-$5.50/cwt relative to non-preconditioned calves. Premiums were lower for calves sold in the winter, heavier calves, and when cattle markets were strong. Based on a 45-day post-weaning preconditioning program, cow-calf producers can increase returns about $14/head compared to selling calves at weaning.

Keywords: feeder cattle, hedonic model, preconditioning, vaccinations

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Introduction

Preconditioning refers to the practice of preparing or "conditioning" calves to enter a grazing or backgrounding program or to go directly into a feedlot for finishing. While the specific aspects of different preconditioning programs might vary, they all basically include a health protocol consisting of various vaccinations and other management practices (e.g., weaning, dehorning, castration, implanting). The basic concept behind preconditioning programs is to implement management practices around the time of weaning so as to improve the calf's health status before it is exposed to future stressors and pathogens. This concept has been around for a long time in the beef industry – Oklahoma State University hosted a national conference to discuss preconditioning in 1967 and Iowa had their first preconditioned calf sale in 1965 (Tindall).

Given that preconditioning has been around for roughly 40 years, one has to wonder why we are still talking about it today. That is, it seems that the practice would either "work" and become an industry standard or it would "fail" and quickly leave the scene as other technologies have over the years. Lalman and Smith point out that industry-wide adoption of preconditioning has been slow and that controversy surrounding the topic is prevalent. Likely this slow adoption and controversy are due to the fact that research is often contradictory (Cole) and also because of the tremendous variability that exists in the beef industry with regards to cow-calf operations (e.g., breeds, weaning weights, size of herd, facilities). Somewhat related to research being contradictory, producers are often reluctant to believe research results that are distant from their operation – i.e., producers often need to "see it before they will believe it."[1]

Regardless of why the adoption of preconditioning has been slow, recent developments in the U.S. beef industry will likely increase the interest in preconditioning. Value-based marketing, food safety concerns, source verification, individual animal identification, and consolidation (at the cow-calf level) are all somewhat compatible with management practices

[1] This statement is based on anecdotal information and years of experience working in extension where producers are often skeptical of research conducted outside of their market or geographical region.

such as preconditioning. How fast these developments will occur remains to be seen, but the reality is that many of the current industry trends are consistent with more interest in preconditioning programs in the future as opposed to less.

While there are trends in the beef industry that point to increased emphasis on preconditioning programs in the future, if these programs are not economical (i.e., more profitable than current practices) producers will not rapidly adopt them. Thus, the question is the same today as it always has been – are expected premiums associated with preconditioning calves sufficient to justify the practice? Thus, the objectives of this study are to (1) determine if there is a price difference between preconditioned calves and non-preconditioned calves in Kansas, (2) estimate the returns cow-calf producers can expect from preconditioning calves compared to selling them at weaning, and (3) determine how sensitive returns are to various production and marketing factors that affect the profitability of preconditioning programs. A final objective is to review previous studies examining how preconditioning calves impacts feedlot profitability, as this will ultimately determine if price premiums are justified and if preconditioning programs will be widely adopted in the industry.

Estimating the Profitability of Preconditioning Calves

In order to estimate the profitability of preconditioning calves, cow-calf producers can either look at historical data to make comparisons with non-preconditioned calves or develop projected budgets based on their expectations of the various production and marketing factors. Because historical data of "side-by-side comparisons" of the returns for preconditioned and non-preconditioned calves rarely exists, developing projected budgets is typically the approach used. The analysis for this paper uses projected budgets to compare expected returns from a 45-day post-weaning preconditioning program to selling calves at weaning. While this approach is fairly straight forward, it does require expected selling prices of preconditioned calves relative to prices of non-preconditioned calves. Thus, one of the first questions to answer is, do preconditioned calves receive a premium compared to non-preconditioned calves, and if so, what is the magnitude of the premium? In addition to potential price premiums, production

information (e.g., average daily gain, death loss, shrink) and cost information (e.g., labor, feed, vaccinations) associated with the preconditioning program are needed. Production factors will impact the selling price due to temporal (45 days post weaning) and form (weight) changes in the product being sold (calf). Thus, it is important to account for the effect of these changes, as well as potential premiums, when estimating the selling price of preconditioned calves.

Premiums Associated with Preconditioned Calves

Several studies have estimated the premiums associated with various preconditioning programs. King et al. estimated the average premium on calves in the VAC-45 program sold through the Superior Livestock Video Auctions from 1994 to 2001 to be $3.04/cwt. The premium averaged $3.61/cwt over the most recent five years of this time period (1997-2001) suggesting a possible upward trend in premiums for preconditioned calves. McKinnon and Greiner report 5-year average premiums for calves in the Virginia Quality Assured (VQA) program ranging from $1.85/cwt to $4.25/cwt depending on the sex and weight of the calf. Avent, Ward, and Lalman estimated average premiums ranging from $1.96/cwt to $3.36/cwt for calves sold in preconditioned vs. regular sales in Joplin, Missouri. Their analysis included both a time series data set (data from December 1997 to March 2001) as well as a cross section data set (data from preconditioned and regular sales on three consecutive days in December 2000). Lalman and Smith concluded that premiums of $3-$8/cwt may be justified for cattle that have undergone management protocols as they list in their article. They report that premiums of that magnitude were received on calves sold in the Lincoln County Preconditioned Calf Sales in the mid eighties in Oklahoma, but they also point out that the sale was discontinued due to lack of interest when market prices rose significantly. This is somewhat ironic because, as Bailey and Stenquist point out, preconditioning programs should be valued the most during periods of high calf prices as there is more incentive to reduce death loss.

Price Model to Determine if Premiums Exist

The use of hedonic models for determining the value of cattle characteristics as well as market

related factors has been widely accepted in the literature. Thus, the price for a given lot of cattle can be expressed as

(1) *Price = f* (*cattle characteristics*, *market-related factors*),

where *cattle characteristics* represents physical characteristics of the lot of cattle (e.g., color, weight, condition) and *market-related factors* represent factors such as size of the lot and type of sale cattle are sold at (i.e., regular auction verus special preconditioned sale). The focus of this research is on the coefficient(s) related to sale type. That is, after accounting for market-related factors and cattle characteristics, is there a significant effect of sale type on the price received?

Data

The Holton Livestock Exchange (Holton, Kansas) conducts its weekly auction sale on Tuesdays and beginning in the late 1990s started holding a preconditioned calf sale on a Thursday evening in the fall (October/November) and another one in the winter (January/February) – i.e., two preconditioned sales per year.[2] Beginning in the fall of 1999 and continuing through the winter of 2004, data have been collected on individual lots of cattle sold through the preconditioned sale (LMA-VACC sale) as well as the regular auction sale by two extension agricultural agents. Data were collected on the majority of lots sold in the LMA-VACC sale as well as the regular auction sale held the same week (i.e., data from regular auction sale held on Tuesday and from LMA-VACC sale held on Thursday evening).[3] Information was collected on cattle characteristics such as price, breed/color, weight, sex, condition. In addition to cattle characteristics, data were recorded regarding lot size and order. The final data recorded were daily CME nearby feeder cattle futures prices for the days of the sales. The data collection process has evolved somewhat

[2] The preconditioned sale was referred to as the "Special Calf Sale" initially, but currently is referred to as the "LMA-VACC sale" as the preconditioning requirements are LMA (Livestock Marketing Association) certified. The health protocol has been fairly constant over the entire time period and thus data from all sales are included in the analysis. Information on the specific requirements of the LMA-VACC program can be found at http://www.lmaweb.com/.

[3] The one exception to this was the winter 2004 sale where data were collected from the regular auction sale on the week following the LMA-VACC sale due to low volume the previous week as the result of the BSE announcement in December 2003.

over time and thus the information recorded pertaining to lots has changed slightly, however, it has always been consistently recorded within a particular week.

Estimated Price Premium Results

Models of the general form of equation (1) were estimated using OLS for each of the 10 different time periods (5 years x 2 sales/year) which included data from the LMA-VACC sale and the regular auction sale from that same week. As previously stated, the cattle characteristic variables varied slightly from time period to time period, but as a general rule the model included variables such as *sale*, *lot size*, *sex*, *weight*, *uniformity*, *condition*, *frame*, *muscle*, *health status*, and *breed/color*. The *sale* variable was a binary variable equal to 1 if the lot was sold in the LMA-VACC sale and equal to 0 if the lot was from the regular auction sale. The coefficient on the *sale* variable was adjusted by feeder cattle futures price changes from Tuesday to Thursday and this adjusted coefficient serves as a proxy for the premium associated with preconditioned calves.[4,5] The estimated premiums by time period are reported in table 1. On average, calves sold in the LMA-VACC fall sale received $4.62/cwt ($25.92/head) more than comparable calves that sold in the regular auction sale. The premium on preconditioned calves sold in the winter sale have been less, averaging $3.22/cwt ($19.27/head). This is not unexpected given that non-preconditioned calves sold in the fall time period would generally reflect freshly weaned calves, whereas, in the winter the non-preconditioned calves have likely been backgrounded and hence they are more comparable to preconditioned calves. The fall premium has ranged from a low of $3.90/cwt to a high of $5.45 and the winter premium has ranged from $2.30 to $4.63/cwt. Thus,

[4] The futures price adjustment was included to account for changing market conditions between the two sales and was simply subtracted from the estimated coefficient. For example, if the *sale* coefficient is $3.00/cwt and the nearby CME feeder cattle futures price increased $0.50/cwt from Tuesday to Thursday, the premium associated with preconditioned calves was calculated to be $2.50. If futures prices decreased by $0.75, then the premium was calculated to be $3.75/cwt.

[5] It is important to recognize that the estimated coefficient on the sale variable does not necessarily represent a premium paid for preconditioned calves. Rather, it reflects a premium for calves *sold in a preconditioned sale* and thus the premium could be due to other factors (e.g., sale day/time (Thursday evening versus Tuesday day), type of buyer). However, this distinction is not particularly relevant since a seller has to precondition his calves in order for them to be eligible to be sold in the LMA-VACC sale.

fall premiums are not only higher, but they are also slightly less variable relative to winter premiums.

A second model was estimated with OLS where the data were aggregated over all time periods (i.e., a single model was estimated as opposed to 10 separate models). Aggregating the data allowed for additional variables to be included in the model (e.g., interaction of season and futures price with sale), but it also required some data to be dropped due to missing variables. Table 2 reports the descriptive statistics of the aggregated data as well as the p-value associated with a two-tailed t-test of the means of individual characteristics. Several of the means for calves sold in the LMA-VACC sale are statistically different from those sold in the regular auction sale suggesting cattle quality does differ somewhat between the two groups.

Estimated parameters related to the LMA-VACC variable from the model estimated with the aggregated data are reported in table 3 with the corresponding calculated premiums shown in figure 1. Consistent with the results reported in table 1, premiums are larger in the fall relative to the winter, however with this analysis the difference is significantly larger ($2.93/cwt vs. $1.40/cwt). Premiums per cwt decrease as the weight of the calf increases and also for heifers relative to steers although the coefficient for heifers is only marginally significantly different from zero. Similar to what Lalman and Smith reported, the premium on preconditioned calves is negatively related to overall market conditions, i.e., premiums decrease as the feeder cattle futures price increases.

Based on the two different analyses of the data from the Holton Livestock Exchange LMA-VACC and regular auction sales, it would appear reasonable to expect a premium of $4.50-$5.50/cwt for preconditioned calves sold in the fall.

Projected Budget for 45-Day Preconditioning Program

A partial budget can be used to compare the additional returns and costs associated with preconditioning to simply selling calves at weaning. That is, the costs of producing the calf can be ignored as they are presumably the same whether the calves are preconditioned or not. Table 4 shows a projected budget for preconditioning steer calves 45 days and then selling them. The

returns from this preconditioning program are compared to selling the calves at weaning (i.e., 45 days earlier). In addition to the baseline scenario (i.e., the expected value of preconditioning), there are five alternative scenarios that have been included as a sensitivity analysis to examine how various factors affect the projected returns.

The production factors (i.e., ADG, death loss, shrink) and cost factors are based on previous studies, historical averages, and personal experience working with producers and animal scientists. The following is a line by line discussion of the baseline budget. Section A of table 4 shows the expected revenue under the traditional management (i.e., no preconditioning). It is assumed the weaning weight is 550 pounds and there will be 4% shrink giving 528 pounds to sell at a price of $93.97/cwt (1999-2003 average for Sept-Oct in Kansas) for a gross revenue of $496 per head.

Section B of table 4 shows the production (i.e., days, ADG, death loss) and the expected income when preconditioning. The length of the preconditioning program in this budget is assumed to be 45 days. According to McCollum and Gill, preconditioning programs have routinely been 14-45 days, with a standard of 21-30, but the benefits of a 45-day program are increasingly being documented. The average daily gain (ADG) is 1.33 lbs/day, based on an average of 1.0 ADG for the first 30 days and 2.0 ADG for the last 15 days (Bailey and Stenquist). Given the 45 days and 1.33 lbs/day gain, the ending weight (pre-shrink) is 610 pounds, or 60 pounds heavier than the weaned calf. Shrink with preconditioned calves can be less than that of fresh weaned calves (Progressive Farmer, Coffey and Skiles) and thus a slightly lower shrink of 2.5% was assumed for the preconditioned calves. A death loss of 0.25% was included in the budget because the cow-calf owner maintains ownership in the calves an extra 45 days so it is possible there will be some death loss. However, death loss is expected to be low given that the calves remain on the farm and are not commingled with calves from other herds. After accounting for shrink, the sale weight of the preconditioned calves is 595 lbs, almost 70 pounds heavier than the weaned calves.

When estimating the price for the preconditioned calves there are numerous factors that need to be taken into account. First of all, the calves will be marketed at a different time of the

year and thus prices need to be adjusted for seasonal patterns. Historically, prices increase slightly from Sept-Oct (assumed time frame for weaned calves) until the first of December, i.e., 45 days post weaning (figure 2). Based on the $93.97/cwt price of weaned calves in Sept-Oct, we would expect prices to increase by $2.41/cwt by Nov-Dec based on historical seasonality. However, the fact that the calves will be 67 pounds heavier also has to be taken into account. Figure 3 shows an expected price slide for feeder calves based on a fed cattle price of $74/cwt and a corn price of $2.30/bu (Dhuyvetter, Schroeder, and Prevatt). Based on the selling weight of 595 versus 528 pounds, the preconditioned calves are expected to be discounted $4.93/cwt due to weight. Another consideration is whether or not preconditioned calves will get "fleshy" and receive a discount for that. There have been numerous studies over time examining the factors affecting feeder cattle prices (e.g., Lambert et al., Mintert et al., Sartwelle et al.) and many of these have shown that fleshy cattle are discounted at times. However, the impact of fleshiness depends on weight of the cattle, season of the year, and the degree of fleshiness. Because the ADG assumed in the budget is only 1.33 lbs, it is assumed that fleshiness will not be a problem and thus there is no price adjustment for fleshiness. The last price factor to consider is how much of a premium is expected for the preconditioned calves when they are marketed. For this analysis a premium of $4.50/cwt is used (low end of the range reported in the previous section).

When all of the price adjustments are taken into account, the selling price for the preconditioned calves is almost $2/cwt higher than the price of the weaned calves ($95.95 vs. $93.97), even though the calves are approximately 70 pounds heavier. That is, the seasonal adjustment and the premium associated with selling a preconditioned calf more than offset the discount associated with the calves being heavier. It should be noted that producers likely will not receive the $4.50/cwt premium simply by selling their calves through their normal outlets – i.e., the premiums reported here were based on a "Special Calf Sale."

Section C of table 4 reports the estimated costs of the preconditioning program. The projected budget is a "generic" representation and thus costs were estimated with dollar amounts to be consistent with what others have reported and not to represent specific ingredients and

products. Interest cost is based on the full cost of the weaned calf for 45 days because this income could have been used to pay off debt or be invested elsewhere had the calves been sold. Additionally, interest is charged on half of the feed and vaccination costs. A yardage charge of 15¢ per head per day was included for labor and equipment costs. This cost will vary tremendously between operations due to the investment in facilities and equipment as well as the number of head being preconditioned. The total cost for the 45-day period is estimated to be approximately $60/head.

Lalman and Smith suggest that costs for a 45-day program will likely fall in the $35-$60 per head range. Bailey and Stenquist show a cost of $56/head in their 45-day preconditioning budget. Lane reports a cost of $38 per head based on a University of Tennessee research trial. Preconditioning demonstrations in Tennessee had 45-day per head costs ranging from $48 to $62 (Rawls). Pate suggests it will cost $30 to $35 per head to precondition a calf for four weeks after weaning in Florida. St. Louis et al. report costs ranging from $28 to $45 per head, depending on the feeding program, for a 30-day preconditioning program in Mississippi. Given these various studies, the costs reported in table 4 seem realistic and possibly a little conservative – i.e., efficient producers could likely shave $5-$10 off the reported values. Based on the cost of $60.36 per head, this equates to a cost per day of $1.34. Once again, these costs estimates tend to be slightly higher than what is typically reported and hence are likely conservative.

Once the information in sections A, B, and C of table 4 has been identified, it can be determined whether or not preconditioning is expected to be profitable. Based on the assumptions used in this budget, the net return to preconditioning is estimated to be $14.16/head. Net returns to preconditioning as a percent of the dollars spent for preconditioning (total cost) represent a 23.9% return (on an annualized basis it would be 190.3%). The breakeven price needed for the preconditioned calves is $93.57/cwt, which is less than the weaned calf price due to the added weight. The breakeven premium needed for preconditioning, all else equal, is $2.11/cwt. That is, the $4.50/cwt premium assumed could drop by $2.39/cwt and preconditioning would still breakeven with selling the calves right off the cow at weaning.

Sensitivity Analysis of the Returns to Preconditioning

Because many of the values in table 4 represent projections, it is useful to conduct a sensitivity analysis around the primary variables impacting profit. This type of analysis can provide some insight as to the economic risk associated with preconditioning calves. The five different scenarios considered, in the order as they appear in table 4, are the following: lower average daily gain, ADG (-); higher average daily gain, ADG (+); higher death loss, D.L. (+); higher cost, Cost (+); and higher feeder cattle prices, Price (+).

With the exception of ADG (+) and Price (+), all of the scenarios considered represent negative changes relative to the baseline. This is not to say that producers only have downside risk because things could improve relative to the baseline budget just as well. Rather, it was simply done to see if preconditioning is still profitable given poorer conditions than the baseline expectations. Changes in ADG of 0.33 lbs/day in either direction impacted net returns a little over $7.50/head. Given the assumptions used in this budget, net returns drop to zero if ADG drops below 0.74 lb/day. As pointed out earlier, if ADG increases to the point where calves become fleshy, then a price discount would possibly need to be included. If death loss increases from 0.25% to 1.0%, net returns drop by about $4 per head but they are still positive. At death loss levels in excess of 2.8%, net returns become negative (all else equal). The higher cost scenario, Cost (+), represents costs increasing roughly 20 percent compared to the baseline budget via increased feed and medicine costs. Net returns are still positive, but at $2.10/head, preconditioning is only slightly better than a breakeven proposition under these assumptions. The cost per head per day is $1.61 compared to $1.34 in the baseline budget. Based on the previous discussion of costs, as a rule-of-thumb, producers should target per-head-per-day costs in the range of 90¢ to $1.35.

A final sensitivity analysis scenario considered was to value weaned calves at much higher prices than the 5-year average in the baseline, Price (+). At this higher price ($110/cwt vs $93.97/cwt), holding everything constant except the seasonal and weight price adjustments, the net return to preconditioning increased from $14.16 to $20.78 per head. This suggests that the value of preconditioning is greater when prices are high assuming a constant premium for the

calves. However, if buyers reduce premiums when prices are high (as was shown in table 3), this result would not hold. At these higher calf prices, the breakeven premium needed is only $1.00/cwt which is still considerably lower than what would be expected based on the results in table 3, and thus preconditioning calves would still be more profitable than selling calves directly off the cow at weaning.

Value of Preconditioned Calves in the Feedlot

The values reported in table 4 indicate that cow-calf producers can increase their expected returns by preconditioning calves if they receive a premium of $4.50/cwt. A logical follow-up question is, are premiums of this magnitude justified from the cattle buyer's perspective (i.e., person buying calves to finishing out in a feedlot)? If preconditioned calves experience less health problems in the feedlot and gain weight more efficiently than non-preconditioned calves, then a premium of some amount is justified. Furthermore, given the beef industry's trend towards more value based marketing, premiums could be paid for preconditioned calves if their end value (i.e., carcass) is worth more. Numerous studies have found that preconditioning and the health status of calves significantly improves feedlot performance, due to lower morbidity and mortality, and in some cases also improves carcass quality (e.g., Cravey; Gardner et al., 1996, 1999; McNeill; Nyamusika et al.; Roeber and Umberger). The improved performance results in lower medical costs and costs of gain. The improved carcass quality will result in higher revenue if cattle are marketed on a value-based system.

Thus, it stands to reason that preconditioned calves should bring a premium, but how much should this premium be? The premiums shown in table 1 and figure 1, along with other findings previously discussed, indicate that cattle feeders have generally been willing to pay somewhere in the range of $2-$5/cwt for preconditioned calves. Is this the "full value" of preconditioning, or do cattle feeders pay less than the full value such that they retain some of the value themselves (as opposed to passing it on to the cow-calf producer)? From a theoretical standpoint, we would expect that the premium paid by cattle buyers would be less than the full value because of the risk involved. That is, because uncertainty with regards to cattle health and

performance exists, even with preconditioned calves, cattle buyers will factor that into the price they pay and thus premiums likely will be less than the full value of preconditioning.

In his 1984 article summarizing preconditioning trials conducted in the 70's and early 80's, Cole concluded that “Although theoretically sound, the practice of preconditioning will not, in general, reduce sickness sufficiently to repay the cost of the program.” (p. 21). He also pointed out that the results of controlled experiments and surveys were often contradictory. Producers should attempt to rely on controlled experiments when possible, as opposed to testimonials, because they likely represent “repeatable results” more so than testimonials and anecdotes. However, in the absence of well-designed research trial data, producers still need to make decisions and thus they often need to rely upon whatever information they can identify. Thus, it could be argued that Cole’s condemnation of survey data may be somewhat misplaced. Furthermore, the economics of preconditioning programs might be considerably different today compared to 20 years ago due to changes in management styles, vaccines, etc. Therefore, it is important to look at more current studies to determine if buying preconditioned cattle is economical for cattle feeders.

In a Colorado State University study, Roeber and Umberger compared the net returns to feeding (NRTF) for two groups of preconditioned calves from value-added calf (VAC) programs in Kentucky with calves purchased through auction markets in the same region. The NRTF of the calves that had been preconditioned before being shipped to Colorado were $46.83 and $49.54 per head higher than the calves with unknown health and processing history (auction market calves). Based on a 550 pound beginning weight, these increased returns represent increased values of $8.53/cwt and $9.00/cwt, respectively. In a simulation of the economic impacts of bovine respiratory disease complex (BRDC), Nyamusika et al. found returns to vaccination combined with treatment of $44 per head for a feedlot in the midwest. Based on a 600 pound beginning weight, this increase equates to an added value of the feeder calf of $7.33/cwt. Furthermore, there was considerably less variability (i.e., risk) in net returns with this health program. The authors concluded that “preconditioning health programs for newly weaned calves would improve efficiency of the feeder cattle marketing system.” (p 52).

Cravey compared the economic returns of 380 preconditioned heifer calves versus 1,600 weaned and shipped calves in a commercial feedlot setting and concluded that the returns to preconditioning were $60.72 per head ($11.04/cwt). In a second study, Cravey compared the net returns of 15 lots of preconditioned calves to 15 lots of similar non-preconditioned calves. In this study, the value of preconditioning in the feedlot phase was estimated to be $55.93 per head ($9.67/cwt). In both studies, the finished cattle were marketed on a live-weight basis and thus if preconditioning improves carcass quality, these increased returns are conservative estimates as to the total increased value of preconditioning calves that are marketed on a value-based system.

Based on this limited data, it would appear that the value of preconditioned calves is somewhere between $40 to $60 per head in the feedlot which equates to price premiums that could be paid for the calves of $7-$11/cwt. Avent, Ward, and Lalman surveyed feedyard managers from the Texas Cattle Feeders Association as to what they felt preconditioned calves were worth to them in the feedlot sector. The average value reported by the 19 managers responding to their survey was that preconditioned calves were worth $5.25/cwt more than non-preconditioned calves. This lower value may reflect the fact that feedlot managers recognize the risk that still exists with preconditioned calves and thus they are not willing to pass the full added value to the cow-calf owner. Or, this lower value might reflect their experiences working with much larger numbers of cattle over multiple years, compared to the studies reported above. That is, it may be that over many pens of cattle and many years the "true value" of preconditioning is expected to be something less than $40 to $60 per head – i.e., more on the order of $25 to $35.

Data from the Texas A&M University (TAMU) Ranch-to-Rail program (nine years and over 17,000 head of cattle) are presented in table 5. In the annual summary report of the program, net returns are reported for both healthy calves and sick calves – sick calves are defined as those receiving at least one vaccination for bovine respiratory disease (BRD). This comparison makes it easy to see how costly sickness in feedlot cattle can be. The difference in net income between healthy calves and sick calves averaged $91.77 per head and ranged from a low of $49.55 to a high of $151.18. Dividing this net income difference by the in-weight of the

cattle indicates how much sick cattle need to be discounted (or how much of a premium can be paid for healthy cattle). The average price difference over the nine years was $15.09/cwt.

The difference in net income is partially due to production/performance differences – ADG over the nine years has been 0.30 lbs/day higher for healthy calves and death loss has been 3.9% lower. However, in addition to the improved production factors, the carcass quality of the healthy calves has been better, on average, compared to the sick calves. For example, 42% of the healthy calves had choice carcasses compared to only 29% of the sick calves. As the beef industry moves towards more value-based marketing systems, this could be an important consideration of preconditioning programs.

While the difference in net income between healthy calves and sick calves of $91.77 per head clearly points to the importance of keeping calves healthy, it does not necessarily reflect the profitability associated with preconditioning. That is, 100% of preconditioned calves will not necessarily be healthy nor will 100% of non-preconditioned calves be expected to get sick. Thus, to estimate how preconditioning might impact net income in a feedlot, the impact it will have on the percent of cattle being sick needs to be considered. Figure 4 shows the linear extrapolation of the average net income data reported in table 5 for various "levels of sickness." For example, if 100% of the calves are sick, the net income is -$10.83 per head (average value reported in table 5). Likewise, if 0% of the calves are sick, i.e., they are all healthy, the net income is $80.94 per head. The rest of the points in figure 4 simply reflect linear combinations of the net returns of sick and healthy calves. The slope of this line is 0.92 which indicates that net income is expected to change 92¢ per head for every 1% change in the level of sickness. Thus, a 10% change in the level of sickness would equate to a $9.20 per head change in net income. The question now becomes, how does preconditioning impact sickness (morbidity) levels?

In his review of 1970's and early 80's studies, Cole concluded that preconditioning would decrease morbidity about six percentage points (from 26.5% to 20.4% in seven preconditioning studies reviewed). With this level of improvement in morbidity levels we would only expect a $5.61 per head improvement in net income (0.92 x 6.1) which hardly makes preconditioning

economical. In the CSU study (Roeber and Umberger), morbidity decreased from 77.3% for auction market calves with unknown health history to 35.7% for preconditioned calves (average of two programs). An improvement of this magnitude would equate to $38.27 per head [(77.3-35.7) x 0.92] which is quite close to the values of preconditioning they estimated. In their survey of Texas feedlot managers, Avent, Ward, and Lalman, asked managers what impact preconditioning would have on morbidity and mortality levels. The average response was that they expected morbidity to decrease from 36.4% (non-preconditioned calves) to 9.2% for preconditioned calves. Likewise, they expected mortality rates to decrease from 4.3% to 1.5%. Based on the feedlot managers estimate as to the improvement in sickness level, the expected impact on net income would be $25.02 per head [(36.4 - 9.2) x 0.92]. Factoring in the feedlot managers' expectations on 2.8% lower mortality rates would add another $15-$20 per head.

Twenty years ago Cole concluded that preconditioning programs were not profitable for cattle feeders. However, he supported the concept as being theoretically sound and suggested research should take place to make the preconditioning economically feasible. While there still appears to be a lack of well-designed research trials to evaluate the economics of preconditioning, it does appear to be more economically attractive today than in the past. Based on the data presented here, it would appear the economic value of preconditioning is in the range of $40 to $60 per head when finishing cattle. This is in slight contrast to Lalman and Smith who conclude that "Conservatively, preconditioning may capture $50 to $75 per head of additional value from weaning through the packing phase compared to a production system where weaning, vaccination, and other management practices associated with preconditioning occur after shipment from the ranch of origin." (p. 5).

Summary

The concept of preconditioning beef calves has been discussed in the beef industry for over 40 years, yet wide spread adoption of the practice has been relatively slow. Current trends in the beef industry related to value-based marketing, food safety concerns, source verification, individual animal identification, and consolidation are compatible with preconditioning calves

and thus it is anticipated that interest in preconditioning programs will increase in the future. However, this interest will only result in adoption if the practice is profitable. This research has estimated the price premium received for preconditioned calves in Kansas, examined the profitability that might be expected from a 45-day post-weaning preconditioning program for cow-calf producers, and briefly examined the impact preconditioning has in the feedlot sector.

Based on five years of data from a northeast Kansas sale barn, preconditioned calves sold in the fall receive a premium of approximately $4.50-$5.50/cwt relative to comparable non-preconditioned calves. The premium on preconditioned calves sold in the winter are lower than calves sold in the fall ($2.20-$3.20/cwt) and premiums tend to be lower when cattle prices in general are higher. The average premiums estimated in this research appear to be slightly higher than previous studies, however, this difference may be partially attributed to time of the year of the sales. Based on a premium of $4.50/cwt, along with seasonal and weight price adjustments, and total costs of approximately $60/head, a 45-day post-weaning preconditioning program increases returns to cow-calf producers about $14/head compared to selling calves at weaning. However, this added value is dependent on receiving a price premium on the calves and thus producers may need to change the way they market their calves if they choose to precondition them. Most research indicates that buyers have been willing to pay premiums of the magnitude needed when calves are marketed through either “Special Calf Sales” or by certifying that the required protocols of specific preconditioning programs have been met.

The premiums being paid for preconditioned cattle appear to be economically justified by those finishing the cattle in feedlots. Actually, the limited data available tends to suggest that cattle buyers could pay slightly higher prices for preconditioned cattle than currently done. Likely, the reason premiums have been below “the full value” has to do with risk. As the reputation and integrity of preconditioning programs increases, the premiums paid for these calves would be expected to increase and approach the full value of preconditioning. If cow-calf producers feel the premiums they receive do not reflect the full value of the preconditioning program, they should consider retaining ownership through the finishing phase as this would be a method to capture that value.

Finally, producers need to recognize that there are many different ways to define preconditioning programs. Rather than worry about conforming to a specific one (unless required to participate in a particular sale), they need to identify what best fits within their management and resource constraints. If preconditioning calves can help improve the overall health status of calves as well as improve the quality of the end product, these are positive things for the overall beef industry. To ensure that management strategies that benefit the beef industry as well as consumers are implemented, it is important that the proper economic signals (i.e., premiums and discounts) are in place.

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Table 1. Estimated Sale Premium by Time Period and Selected Model Results.

	Season/Year[a]										Fall	Winter	Overall
	F-99	W-00	F-00	W-01	F-01	W-02	F-02	W-03	F-03	W-04	Avg	Avg	Avg
Number of lots in analysis													
Regular auction sale	246	128	75	362	165	222	255	197	197	88	188	199	194
LMA-VACC sale	177	186	171	200	133	216	117	192	203	69	160	173	166
Total	423	314	246	562	298	438	372	389	400	157	348	372	360
Difference (Reg - LMA)	69	-58	-96	162	32	6	138	5	-6	19	27	27	27
Average weight, lbs/head	546.8	569.1	557.6	596.0	577.7	601.2	575.3	608.3	550.5	609.9	561.6	596.9	579.2
Futures price, $/cwt	$80.81	$85.42	$88.60	$90.17	$88.09	$85.57	$81.18	$83.63	$103.32	$85.90	$88.40	$86.13	$87.26
Sale prem, $/cwt	$6.00	$2.43	$4.15	$4.24	$4.69	$2.33	$5.46	$3.58	$2.31	$2.43	$4.52	$3.00	$3.76
Sale prem, $/cwt (adjusted)[b]	$5.45	$2.80	$3.90	$3.94	$3.86	$2.30	$5.21	$4.63	$4.68	$2.43	$4.62	$3.22	$3.92
Sale prem, $/head (adjusted)[b]	$30.47	$16.20	$21.79	$23.63	$22.11	$14.22	$29.40	$27.76	$25.81	$14.55	$25.92	$19.27	$22.59
Independent variables	17	14	15	19	17	15	20	20	18	18			
R-Square	0.70	0.61	0.68	0.62	0.73	0.71	0.64	0.60	0.58	0.74			
RMSE, $/cwt	$4.26	$6.08	$5.46	$6.76	$6.94	$6.88	$6.40	$6.62	$6.56	$5.89			
Average price, $/cwt	$81.62	$88.48	$92.83	$89.90	$87.24	$86.33	$78.31	$83.12	$96.51	$91.82			
RMSPE, %	5.2	6.9	5.9	7.5	8.0	8.0	8.2	8.0	6.8	6.4			

[a] Season (F=Fall, W=Winter), Year (99=1999, 00=2000, etc.)
[b] Adjusted to reflect change in futures price between the time of the regular auction sale (Tuesday) and the LMA-VACC sale (Thursday).

Table 2. Descriptive Statistics of Aggregated Data (data from fall 1999 and winter 2004 dropped from analysis)

	Mean			Std. Dev.		Minimum		Maximum	
Variable	Regular Auction	Special Calf Sale	Difference	Regular Auction	Special Calf Sale	Regular Auction	Special Calf Sale	Regular Auction	Special Calf Sale
Total lots	1599	1415	-184						
Price, $/cwt	85.65	90.14	4.49*	12.46	90.14	50.00	50.00	130.50	132.00
Futures price, $/cwt	88.39	88.56	0.18	6.73	88.56	81.05	81.30	104.50	102.13
Weight, lbs/head	582.3	583.2	0.9	135.7	583.2	300.0	300.0	998.0	995.0
Number in lot, head	3.83	6.08	2.25*	6.07	6.08	1.0	1.0	120.0	78.0
Condition score[a]	2.98	2.92	-0.06*	0.54	2.92	1.5	1.0	5.0	5.0
Frame score[a]	3.53	3.43	-0.11*	0.68	3.43	1.0	1.0	7.0	6.0
Uniform score[a]	1.22	1.28	0.05*	0.52	1.28	1.0	1.0	5.0	3.0
Muscle score[a]	2.07	2.29	0.23*	0.70	2.29	0.0	0.0	5.0	4.0
Horns, %	9.01	1.70	-7.31*	0.29	0.02	0.0	0.0	1.0	1.0
Good health, %	1.63	0.14	-1.48*	0.13	0.00	0.0	0.0	1.0	1.0
Bad health, %	5.69	4.88	-0.81	0.23	0.05	0.0	0.0	1.0	1.0
Steer, %	55.53	54.35	-1.19	0.50	0.54	0.0	0.0	1.0	1.0
Heifer, %	44.47	45.65	1.19	0.50	0.46	0.0	0.0	1.0	1.0
Black/BWF, %	47.90	37.81	-10.10*	0.50	0.38	0.0	0.0	1.0	1.0
Red/RWF, %	13.38	17.88	4.50*	0.34	0.18	0.0	0.0	1.0	1.0
Continental, %	19.01	21.48	2.47	0.39	0.21	0.0	0.0	1.0	1.0
Mixed, %	12.63	18.45	5.81*	0.33	0.18	0.0	0.0	1.0	1.0
Other, %	7.07	4.38	-2.69*	0.26	0.04	0.0	0.0	1.0	1.0

* Denotes difference is statistically different from zero at the 5% level based on two-tailed t-test
[a] Subjective rating as determined by evaluators

Table 3. Estimated coefficients associated with LMA-VACC preconditioned calf sale (dependent variable is price, $/cwt).

Variable[a]	Unit	Parameter Estimate	Standard Error	t-Value	Pr > |t|
LMA	binary	24.6609	4.24	5.81	<.0001
LMAfall	binary	2.9327	0.60	4.90	<.0001
LMAweight	lbs/head	-0.0138	0.00	-6.36	<.0001
LMAfutures	$/cwt	-0.1573	0.05	-3.45	0.00
LMAheifer	binary	-0.8296	0.55	-1.52	0.13
N	3014				
R-Square	0.6380				
RMSE	7.28				

[a] *LMA* is a binary variable for the preconditioned sale and all other variables are interactions between *LMA* and the respective variables (*fall*, *weight*, *futures*, and *heifer*).

Table 4. Projected Budget for Preconditioning Calves 45 Days.

		Alternative scenarios				
	Baseline	ADG (-)	ADG (+)	D.L. (+)	Cost (+)	Price (+)
A. Traditional Management Income						
1 Weaning weight, lbs	550	550	550	550	550	550
2 Shrink	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
3 Sale weight, lbs/head	528.0	528.0	528.0	528.0	528.0	528.0
4 Weaning price, $/cwt	$93.97	$93.97	$93.97	$93.97	$93.97	$110.00
5 Gross revenue, $/head	$496.16	$496.16	$496.16	$496.16	$496.16	$580.80
B. Preconditioning Management Income						
6 Beginning (weaning) weight, lbs	550	550	550	550	550	550
7 Days from weaning to marketing	45	45	45	45	45	45
8 ADG, lbs/day	1.33	1.00	1.67	1.33	1.33	1.33
9 Ending weight, lbs	610.0	595.0	625.2	610.0	610.0	610.0
10 Shrink	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
11 Death loss	0.25%	0.25%	0.25%	1.00%	0.25%	0.25%
12 Sale weight, lbs	594.8	580.1	609.5	594.8	594.8	594.8
13 Weaning price, $/cwt	$93.97	$93.97	$93.97	$93.97	$93.97	$110.00
13a Price adjustment for seasonality, $/cwt	2.41	2.41	2.41	2.41	2.41	2.82
13b Price adjustment for weight, $/cwt	-4.93	-3.85	-6.02	-4.93	-4.93	-5.03
13c Price adjustment for fleshiness, $/cwt	0.00	0.00	0.00	0.00	0.00	0.00
13d Preconditioning premium, $/cwt	4.50	4.50	4.50	4.50	4.50	4.50
14 Final price ($/cwt)	$95.95	$97.03	$94.86	$95.95	$95.95	$112.29
15 Gross revenue ($/head)	$570.68	$562.90	$578.21	$570.68	$570.68	$666.87
C. Preconditioning costs, $/head						
16 Interest (cattle, feed, supplies) @ 6.5%	$4.22	$4.22	$4.22	$4.22	$4.28	$4.92
17 Health supplies and medicine	10.00	10.00	10.00	10.00	15.00	10.00
18 Death loss	1.38	1.36	1.40	5.53	1.38	1.62
19 Labor and equipment	6.75	6.75	6.75	6.75	6.75	6.75
20 Feed, hay, and pasture	35.00	35.00	35.00	35.00	40.00	40.00
21 Marketing costs (tags, comm, etc.)	3.00	3.00	3.00	3.00	5.00	3.00
22 Total cost, $/head	$60.36	$60.34	$60.38	$64.51	$72.41	$66.29
23 Cost per day	$1.34	$1.34	$1.34	$1.43	$1.61	$1.47
D. Comparison: Traditional vs Preconditioning						
24 Traditional gross revenue, $/head	$496.16	$496.16	$496.16	$496.16	$496.16	$580.80
25 Preconditioning gross revenue, $/head	$570.68	$562.90	$578.21	$570.68	$570.68	$667.87
26 Increased revenue, $/head	$74.52	$66.74	$82.04	$74.52	$74.52	$87.07
27 Less preconditioning costs, $/head	$60.36	$60.34	$60.38	$64.51	$72.41	$66.29
28 Net return from preconditioning, $/head	$14.16	$6.41	$21.67	$10.01	$2.10	$20.78
29 Return on costs (line 28 / line 22)	23.5%	10.6%	35.9%	15.5%	2.9%	31.3%
30 Breakeven price, $/cwt	$93.57	$95.92	$91.30	$94.25	$95.60	$108.79
31 Breakeven premium, $/cwt	$2.11	$3.39	$0.94	$2.80	$4.15	$1.00

Table 5. Comparison of Healthy and Sick Calves, TAMU Ranch-to-Rail Program[a]

Production Comparisons

	Average Daily Gain, lbs/day			Death Loss			Percent
Year	Healthy	Sick	Diff.	Healthy	Sick	Diff.	Sick[b]
92-93	2.88	2.68	0.20	0.50%	2.90%	-2.40%	21.9%
93-94	2.92	2.69	0.23	0.01%	2.20%	-2.19%	34.1%
94-95	3.02	2.99	0.03	0.50%	1.70%	-1.20%	23.2%
95-96	3.01	2.91	0.10	0.30%	3.50%	-3.20%	29.8%
96-97	2.96	2.40	0.56	0.60%	7.70%	-7.10%	14.4%
97-98	2.84	2.54	0.30	0.60%	4.00%	-3.40%	26.7%
98-99	3.07	2.64	0.43	1.80%	5.70%	-3.90%	14.0%
99-00	3.08	2.65	0.43	0.70%	5.50%	-4.80%	16.8%
00-01	2.85	2.45	0.40	0.01%	6.90%	-6.89%	22.6%
Average	2.96	2.66	0.30	0.56%	4.46%	-3.90%	22.6%

Carcass Quality Grade Comparisons

	Choice Carcasses			Select Carcasses			Standard Carcasses		
Year	Healthy	Sick	Diff.	Healthy	Sick	Diff.	Healthy	Sick	Diff.
92-93	41%	28%	13%	55%	70%	-15%	4%	2%	2%
93-94	26%	19%	7%	67%	73%	-6%	7%	8%	-1%
94-95	39%	33%	6%	59%	63%	-4%	2%	4%	-2%
95-96	38%	32%	6%	54%	56%	-2%	8%	12%	-4%
96-97	40%	26%	14%	55%	60%	-5%	5%	14%	-9%
97-98	42%	23%	19%	51%	60%	-9%	7%	17%	-10%
98-99	41%	24%	17%	54%	65%	-11%	5%	11%	-6%
99-00	54%	37%	17%	43%	53%	-10%	3%	10%	-7%
00-01	56%	41%	15%	41%	54%	-13%	3%	5%	-2%
Average	42%	29%	13%	53%	62%	-8%	5%	9%	-4%

Economic Comparisons

	Net Income, $/head			Medicine	Lost	Average	Price
Year	Healthy	Sick	Diff.	Cost	Value[c]	In-Wt	Discount[d]
92/93	$176.38	$85.15	$91.23	$27.36	$63.87	593	$15.38
93/94	$2.17	-$86.38	$88.55	$37.90	$50.65	591	$14.98
94/95	$75.69	$26.14	$49.55	$20.76	$28.79	601	$8.24
95/96	-$3.40	-$63.02	$59.62	$34.05	$25.57	605	$9.85
96/97	$112.19	-$5.23	$117.42	$23.36	$94.06	614	$19.12
97/98	-$36.18	-$101.57	$65.39	$22.73	$42.66	630	$10.38
98/99	$80.82	$0.70	$80.12	$21.39	$58.73	609	$13.16
99/00	$146.17	$23.31	$122.86	$26.78	$96.08	619	$19.85
00/01	$174.61	$23.43	$151.18	$44.55	$106.63	609	$24.82
Average	$80.94	-$10.83	$91.77	$28.76	$63.00	608	$15.09

[a] Source: McNeill, McCollum, and Paxschal. (http://animalscience.tamu.edu/ansc/publications/rrpubs/rr_all.html)

[b] Percent of "sick" calves, where sick is defined as animals treated one or more times for BRD.

[c] Lost value is the difference in net income between healthy and sick calves less medicine cost.

[d] Purchase price discount ($/cwt) required on sick calves in order for them to breakeven with healthy calves.

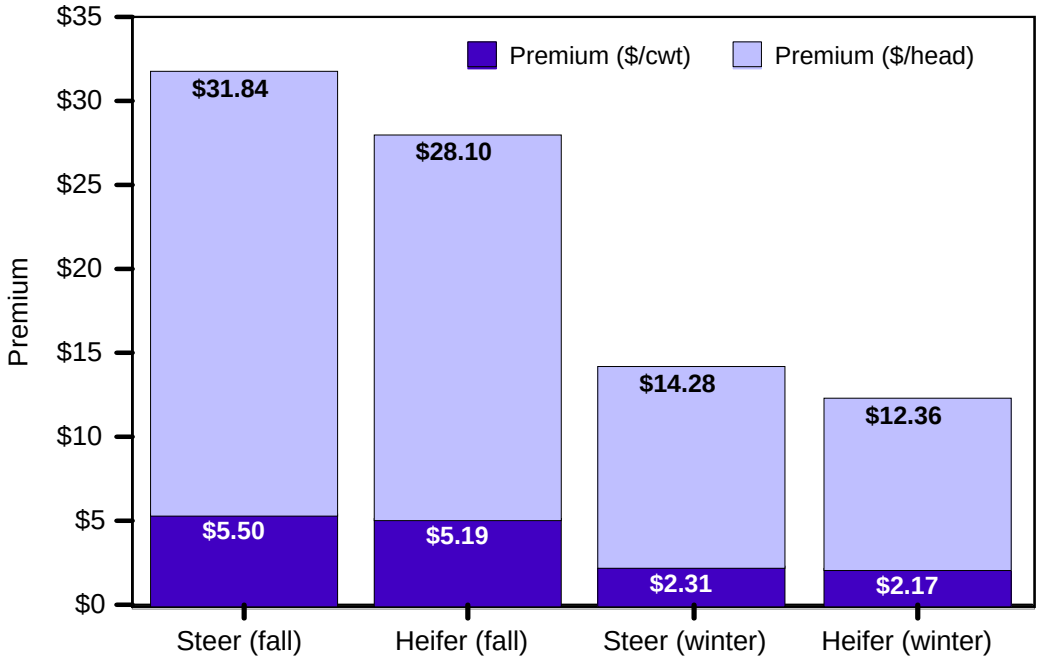


Figure 1. Premium Associated with Preconditioned Calves (evaluated at mean for all variables except sex of calf and season of sale).

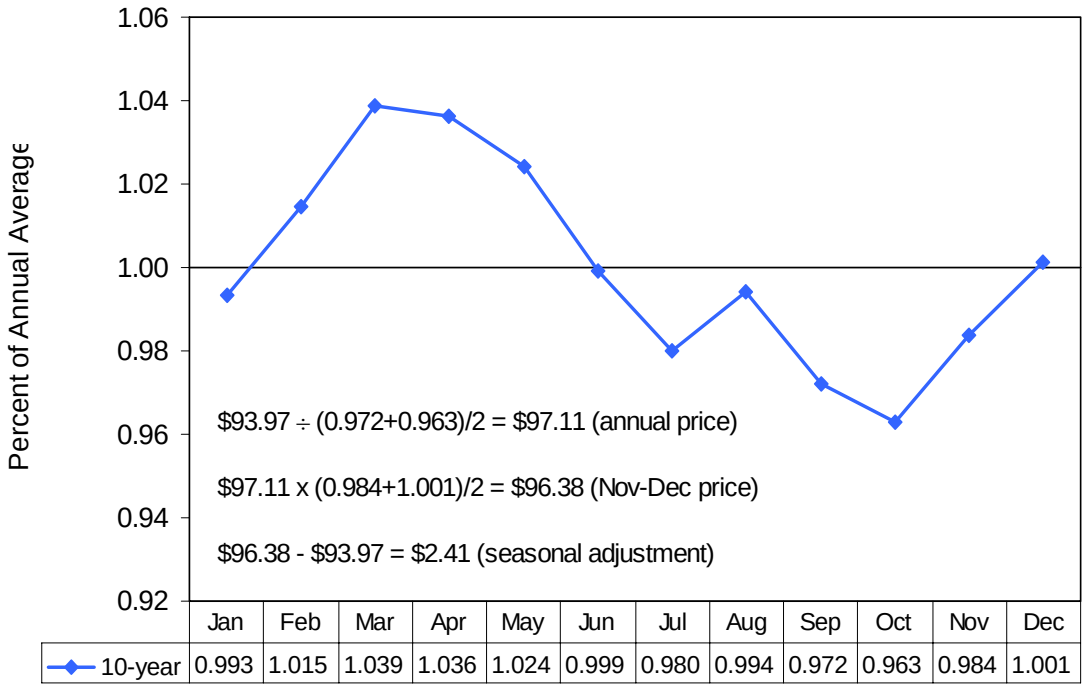
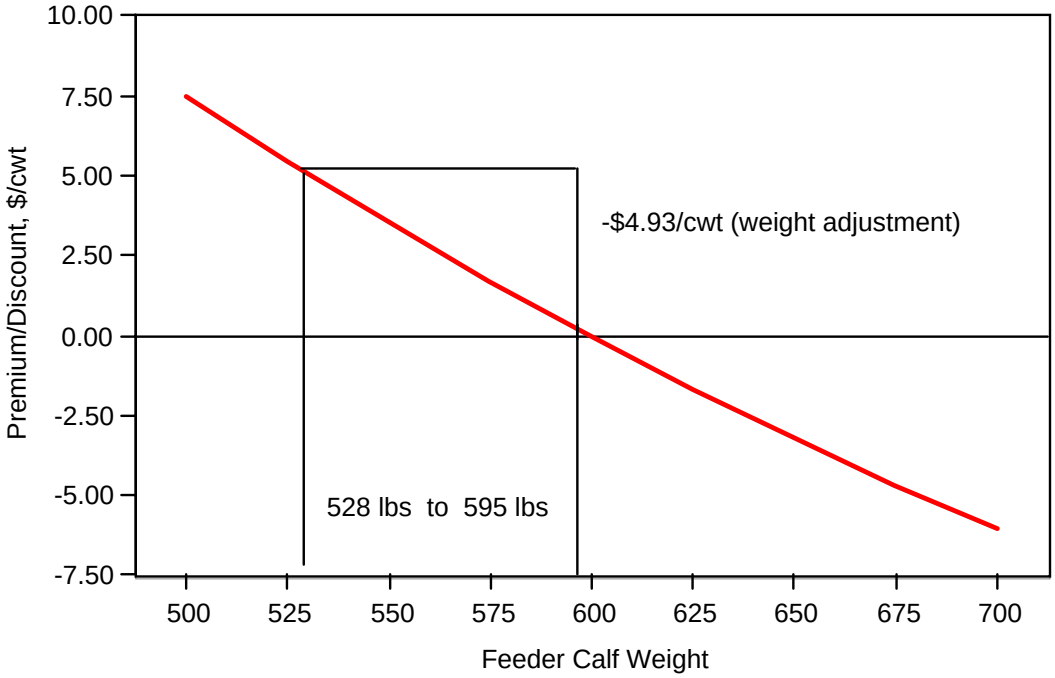


Figure 2. Seasonal Price Index for 500-600 Pound Steers, Kansas Livestock Auctions, 1994-2003.



(based on fed cattle price of $74/cwt and corn price of $2.30/bu)

Figure 3. Price Adjustment Based on Feeder Calf Weight.

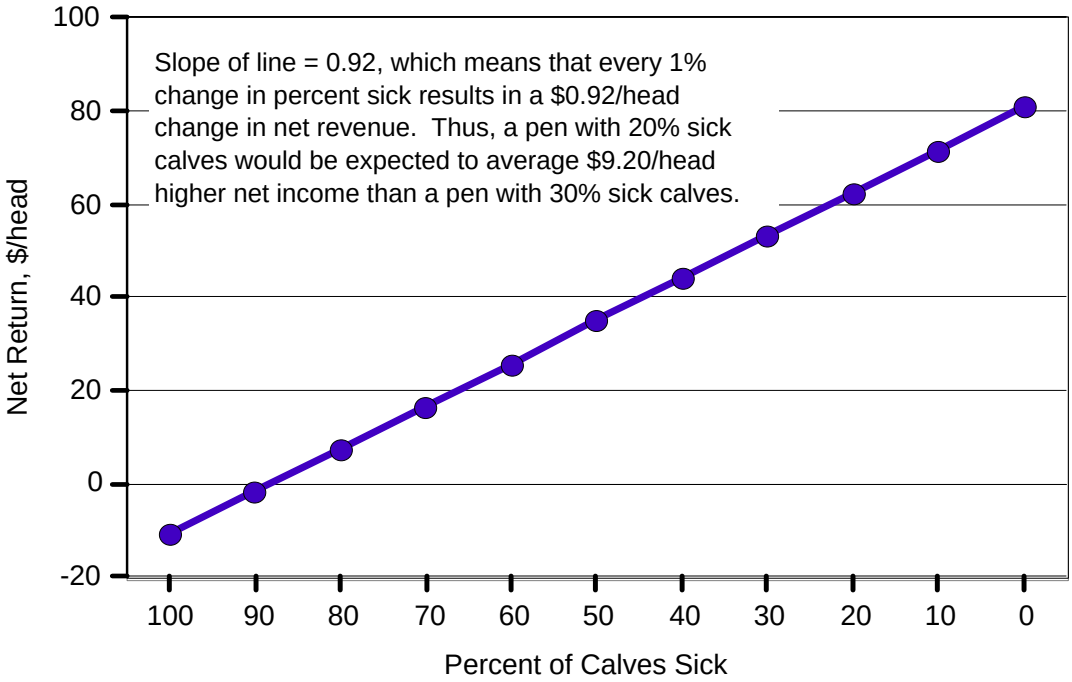


Figure 4. Impact of Health Status on Net Returns (Source: TAMU Ranch-to-Rail Program, 92/93 to 00/01).