Effects of Preconditioning on Health, Performance and Prices of Weaned Calves

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According to the American Heritage Dictionary, to precondition is to condition, train, or accustom in advance. There is no standardized definition for this term as it applies to beef calves prior to, during, and/or after the weaning and shipping period. However, preconditioning is generally used to indicate management practices implemented around the time of weaning that are intended to optimize the animal's immune system and nutritional status while minimizing stress. The outcome of this process is added value to the entire beef production system. This added value is realized through reduced incidence and associated costs of sickness, improved performance in terms of weight gain and feed efficiency, a reduction in drug use and the labor required to treat and manage sick cattle, and improved beef product quality. Cow/calf producers benefit through the development of a reputation for high quality cattle, utilizing management skills and feed resources to add further value to home raised calves, and the opportunity to capture a larger portion of the revenue in cases where some level of ownership is retained.

Organized efforts to encourage standardized management of beef calves prior to weaning and shipment began in 1967. In September of that year, approximately 200 animal and veterinary scientists met at Oklahoma State University to discuss the problems and scientific basis for developing and encouraging these management practices (Gill, 1967). It was at this meeting that the concepts of vaccinating calves prior to weaning or shipping (pre-vaccinating) and "conditioning" calves were combined to coin the term "preconditioning". In beef cattle, the term "conditioning" generally referred to a combination of management practices such as dehorning, deworming, castrating, weaning, and training calves to eat out of bunks or water troughs.

Industry-wide adoption of the preconditioning concept has been painfully slow. Controversy surrounding the topic is still prevalent today. However, recent developments in the U.S. beef industry promise to propel the preconditioning concept forward at a faster rate. Numerous value based marketing programs are now available to beef cattle producers. This marketing approach serves to increase information flow and management coordination up and down the production chain. In this way, stronger signals and incentives are created to encourage the adaptation of the best management practices, such as those associated with preconditioning.

The effects of sickness on performance and carcass traits

Previous work indicates that animal health and medicine costs are the most important animal performance measures determining feedlot cattle profitability (Gardner et al., 1996). For example, compared with steers without lung lesions, steers with lesions plus active lymph nodes had around $74 less net return (Gardner et al., 1998). The effects of sickness on performance and profitability are also clearly demonstrated in data collected on over 16,000 head of cattle in the Texas A&M Ranch to Rail program (McNeil et al., 2000)(Table 1). In this data, animals treated one or more times for bovine respiratory disease (BRD) were considered to be sick. The number of cattle treated for sickness in a given year ranged from 14% to 34%, with an average of 22.4%. Average medicine costs for each animal treated varied considerably among years with a low of $21 to a high of $38 per head. This data shows that the frequency of the occurrence of BRD and associated medicine costs is difficult to predict. This difficulty arises from year-to-year environmental variation and management differences. Consequently, the true value of precon ditioning programs is a moving target and will vary over time and in different situations.

In the Ranch to Rail study, cattle identified as being sick gained 0.32 lb/hd/day less compared to cattle that were never treated. This reduction in weight gain translates to less saleable carcass weight. Perhaps a more important question, and one

Table 1. Influence of sickness on performance, profitability and quality grade in eight years of the Texas A&M Ranch to Rail program[a]

Item	*Healthy*	*Sick*
Number of cattle	12,306	4,047
Medicine treatment cost, $/hd	0	27.03
ADG, lb**	2.99	2.67
Net return, $/hd**	67.32	-20.28
USDA Choice or higher, %**	39.6	27.5
USDA Standard, %*	10.0	5.25

[a]Source: McNeil et al. 2000
*Healthy vs. Sick differs (P = .02).
**Healthy vs. Sick differs (P < .01).

that is yet to be addressed in published literature, is the affect of BRD on feed efficiency. Sickness reduced the number of carcasses grading choice by 12% and increased the number of standard grading carcasses by 5%. Obviously, this impact presents marketing limitations relative to grid pricing systems that are largely driven by quality grade. When death loss, medicine costs, and reduced carcass value were considered, cattle that were identified and treated for sickness returned an average of around $88 less compared to cattle that were never treated for sickness.

In an Oklahoma study (Stoval et al., 2000), cattle that were not treated for BRD graded 66% choice, while cattle treated only once graded 59% choice, and cattle treated more than once graded 41% choice. These experiments point out that the effects of sickness are variable but have the potential to dramatically impact animal performance, profitability, and product quality.

How does preconditioning affect post-weaning performance?

Most calves are healthy when they leave the ranch of origin, but stress caused by weaning, transportation, inclement weather, nutritional deprivation, commingling, and processing lowers their level of disease resistance. This lower resistance to disease comes when disease exposure is high. Vaccination, deworming, and balanced nutrition are all intended to increase the level of immunocompetence (or disease resistance). Weaning, castrating, dehorning, training the cattle to eat feed from a bunk, and other management practices associated with preconditioning are designed to reduce the impact of stress during the shipping and receiving period. When disease exposure is combined with extremely stressful conditions, the disease challenge may override the cattle's capacity for disease resistance. In other words, the fact that cattle have been preconditioned does not guarantee they will not get sick.

Little research includes the large numbers of animals that would be required to estimate the true benefit of preconditioning. Multiple years of data are necessary to determine the variability in the benefit of preconditioning due to year-to-year weather and pasture conditions. Table 2 includes data from a study conducted with a large number of heifer calves from a single ranch (Cravey, 1996). The comparison involved 380 preconditioned calves and 1,600 "weaned and shipped" calves. Preconditioned calves received vaccinations and a dewormer at weaning. Modified live vaccines were boostered 10 to 14 days later, and calves were shipped 45 days after weaning. During the preconditioning period, calves were turned out on grass traps and fed a concentrate pellet with free-choice grass hay. Finished cattle were marketed on a live weight basis. Consequently, economic data presented in Table 2 does not reflect potential differences in carcass traits and associated carcass value.

In this study, preconditioned heifers had improved performance and feed efficiency. Preconditioning dramatically reduced medicine costs and death loss. In fact, the preconditioning program added almost $61/head to the value of the heifers or $11.04/cwt to the initial weaning weight.

In a second and similar experiment, Cravey (1996) compared 15 lots of preconditioned cattle to 15 lots of similar, but non-preconditioned cattle (Table 3). Cattle in the non-preconditioned treatment were purchased through order buyers and were of mixed origin and backgrounds. The preconditioned calves had been certified through the Hi-Pro Producer's Edge program, which requires two rounds of a modified live viral and Pasteurella vaccine, as well as a 45 to 50 day weaning period.

Similar to the previous experiment, animal performance was improved and medicine costs were dramatically reduced. Remember that these cattle were marketed on a live basis, so potential value differences based on carcass quality are not

Table 2. Effects of 45-day preconditioning on feedlot performance and profitability[a]

Item	*Non-precon-ditioned*	*Precon-ditioned*
Performance		
Feedlot in wt. lb.	550	640
Feedlot wt gain. lb.	616	540
Days on feed	220	180
Daily gain lb.	2.80	3.00
Feed:Gain, DM basis	6.60	6.02
Medicine, $/head	34.00	4.33
Death loss, %	4.44	1.30
Feedlot cost of gain, $/cwt	62.80	54.75
Economics		
Preconditioning costs, $/head	-	40
Feedlot cost of gain, $/head	386.85	295.65
Fed heifer value, $/head	795.33	804.88
Value minus total costs, $/head	408.48	469.23
Difference in net value, $/head	-	60.72

[a]Source: Cravey, 1996 Southwest Nutrition and Management Conference.

Table 3. Effects of 45-day preconditioning on feedlot performance and profitability[a]

Item	*Non-precon-ditioned*	*Precon-ditioned*
Performance		
No. head	1492	1685
Feedlot in wt. lb.	564	579
Feedlot out wt. lb.	1126	1173
Days on feed	217	205
Daily gain lb.	2.59	2.88
Feed:Gain, DM basis	6.45	5.98
Medicine, $/head	30.66	13.74
Death loss, %	2.61	.53
Cattle pulled for treatment, %	62.0	19.0
Feedlot COG, $/cwt	56.70	49.68
Economics		
Feedlot COG, $/head	318.65	295.10
Fed cattle value, $/head	771.13	803.51
Value minus total costs, $/head	452.48	508.41
Difference in net value, $/head	-	55.93

[a]Source: Cravey, 1996 Southwest Nutrition and Management Conference.

reflected in the budget presented in Table 3. The preconditioning program added almost $56 to the value of the cattle. In other words, the cattle feeder could have paid $9.67/cwt more for the preconditioned calves and profited the same amount if the finished cattle were sold on a live weight basis. With this data set, the actual weight gain and costs during the preconditioning period are unknown; however, if we apply the same costs as used in the previous experiment ($40) and assume that the value of each pound of added weight is worth $.55, the breakeven weight gain during preconditioning would be 73 lbs, or 1.6 lbs per day for 45 days ($40 / $.55 per lb = 73 lbs).

More data is needed to identify the true value of preconditioning for various cattle types, phases of the industry (feedyard vs. stocker), time of the year, region of the country, and different management regimes. Using the data available, preconditioning does appear to result in a substantial reduction in sickness, death loss, and medicine costs. These improvements appear to result in better animal performance and lower cost of feedyard gain. There is even more value to preconditioning when carcass quality is considered. Based on the limited data available, it appears that premiums of $3 to $8/cwt may be justified for cattle that have undergone management protocols similar to the ones mentioned above. Premiums in this range would encourage more cow/calf producers to adopt the practice, while preserving some of the added value for the stocker and/or finishing segments of the industry.

Does the industry currently reward cattlemen for preconditioning calves?

Research is now available that attempted to quantify the effect of value added health programs on the price paid for beef calves sold through "special" feeder cattle auctions or through video auctions. Table 4 includes sale prices for calves in six special preconditioned calf sales held in Lincoln County, Oklahoma during the 1980s. Sale requirements included the following:

- A minimum of 10 head (could be mixed steers and heifers)
- Within 30 days prior to sale cattle had to be castrated, healed, dewormed, and treated for external parasites.
- A minimum of 30 days prior to sale, cattle had to be weaned and vaccinated with IBR, BVD, PI_3, 5-way Lepto, and 4-way clostridial vaccines.
- Cattle were to be fed a minimum of 200 pounds of a commercial preconditioning feed within a 21-day period prior to the sale.

Actual sale prices were compared to weighted average sale prices for U.S. number one medium and large frame calves selling during the same week at the Oklahoma National Stockyards in Oklahoma City, Oklahoma. According to this data, it is evident that cattle buyers were willing to pay a premium for preconditioned calves, and this premium tended to grow over time. An important observation, however, was that enrollment in this preconditioning program dropped dramatically after the market significantly improved in 1987. Demand from buyers remained high but when calf prices were high, cow/calf producers lost interest and the sales had to be discontinued. This happened in spite of the fact that premiums had increased over time from five or six percent to ten or eleven percent of total calf value.

For several years, Superior Livestock Video Auction, Inc. has encouraged the use of standardized and certified vaccination and weaning programs. Since, 1994, sale price on over 14,000 lots, representing over 1.75 million cattle have been recorded and evaluated for difference in sale price depending on vaccination and weaning status. Table 5 shows the total number of lots for each year and the percentage of lots consigned and marketed under four different categories.

Enrollment in the two levels of certification shown here started extremely slow but continue to increase over time. Since 1995, the number of cattle identified as having no vaccinations has steadily declined. In 1995, only 15.6% of the lots included in this data set were enrolled in one of the certification programs, whereas in 2000, 37% of the lots had

Table 4. Premiums paid for 400 to 500 pound calves marketed through Lincoln County Preconditioned Calf Sales[ab].

Gender	*Year*	*OKC Price [c] $/CWT*	*Lincoln Co. Price $/CWT*	*Premium $/CWT*	*Premium $/Head*	*Premium % of total cost*
Steers	1982	65.50	69.74	4.24	19.08	6.5
	1983	67.25	71.61	4.36	19.62	6.5
	1984	67.25	72.46	5.21	23.45	7.7
	1985	69.00	74.42	5.42	24.39	7.9
	1986	71.00	78.32	7.32	32.94	10.3
	1987	90.50	99.25	8.75	39.38	9.7
Heifers	1982	55.00	57.76	2.76	12.42	5.0
	1983	53.50	56.27	2.77	12.47	5.2
	1984	55.00	58.23	3.23	14.54	5.9
	1985	57.63	62.83	5.20	23.40	9.0
	1986	62.13	68.40	6.27	28.22	10.1
	1987	77.00	85.63	8.63	38.84	11.2

[a]Source: Wayne Shearheart (Unpublished data).
[b]Sales were held during the fourth week of October each year.
[c]Weighted average price for U.S. number 1 medium and large frame calves selling during the same week at the National Stockyards in Oklahoma City, Oklahoma.

Table 5. Number of sale lots by year and value added health program for beef calves sold through Superior Livestock Video Auctions[a].

Year	Total number of lots in data analysis	Value added health program administered to sale lots, % of total			
		Not certified [b]		Vaccinated	
		Not vaccinated	Vaccinated	Not weaned Certified [c]	Weaned Certified [d]
1994	1,930	88.3	-	8.3	1.8
1995	1,576	43.7	38.6	12.4	3.2
1996	1,793	34.0	33.9	27.7	4.5
1997	1,902	29.8	33.2	23.1	4.5
1998	2,410	18.0	26.5	21.3	5.0
1999	2,600	17.7	32.8	30.3	6.9
2000	2,406	18.0	47.0	26.0	9.0

[a]Source: King et al., 1994 through 1998 CSU Beef Program Report and Pfizer Animal Health Final Reports, 1999 through 2001. Average lot size was approximately 123 head each year.
[b]Calves in this category were vaccinated against one or more of the following viruses at some time between birth and the date of sale: IBR, BVD, PI3, and BRSV.
[c]Vac 34. For certification requirements see King and Odde, 1998.
[d]Vac 45. For certification requirements see King and Odde, 1998.

qualified for one of the two certification programs shown. Even though participation is increasing in the certified program that includes a minimum 45-day weaning period, participation is still extremely low despite the potential value to the buyer and the industry as a whole.

Table 6 includes the average price paid for calves that were not vaccinated or certified, as well as price differences (premium, $/cwt) paid for calves with varying vaccination, certification, and weaning status. Using only the data from 1995 through 2000, the average premium paid for calves identified as having one or more viral vaccinations with no certification, was $0.80/cwt. When a standardized and certified vaccination protocol was used, the average six year premium was increased to $3.34/cwt. when calves were certified as being vaccinated and weaned under the Vac 45 requirements. When calculated relative to total calf value, Vac 45 calves have returned an average premium of four to five percent.

Intuitively, the value of preconditioning should differ between cattle shipped directly from the ranch and those that are collected and marketed at central auction facilities. Because the potential exists for greater exposure to disease and animal stress, the premium for preconditioned calves marketed through auction facilities should be greater compared to those shipped directly from the home ranch. More data is necessary to adequately document whether this premium difference exists.

Table 6. Effect of value added health programs on the price of beef calves sold through Superior Livestock Video Auctions[a].

Year	Value added health program administered to sale lots			
	Not vaccinated Not certified	Vaccinated Not certified [b]	Not weaned Vaccinated Certified [c]	Weaned Vaccinated Certified [d]
	Price, $/cwt	-------Premium over non-vaccinated and non-certified, $/cwt-------		
1994	83.80	-	.77	.25
1995	67.79	.70	1.35	2.47
1996	61.79	.43	.99	3.35
1997	91.26	.72	1.61	3.89
1998	73.86	.74	1.38	3.35
1999	85.92	.96	1.17	3.33
2000	100.06	1.27	1.76	3.66

[a]Source: King et al., 1994 through 1998 CSU Beef Program Report and Pfizer Animal Health Final Reports, 1999 through 2001. Average lot size was approximately 123 head each year.
[b]Calves in this category were vaccinated against one or more of the following viruses at some time between birth and the date of sale: IBR, BVD, PI3, and BRSV.
[c]Vac 34. For certification requirements see King and Odde, 1998.
[d]Vac 45. For certification requirements see King and Odde, 1998.

What does preconditioning cost the cow/calf producer?

When calves are vaccinated, weaned, and retained for at least 45 days prior to shipment, preconditioning costs realistically range from $35 to $60 per head. Cattlemen often ignore indirect costs such as interest, their own labor, and equipment depreciation. The nutrition program typically makes up 45% to 60% of the total budget (Table 7), and should receive careful consideration. High quality pasture, such as winter annual forages; stockpiled cool season grass species (fescue, brome etc.); and stockpiled bermudagrass should result in lower cost and greater returns compared to dry-lot feeding programs. Calves can be held in a pen or dry lot for three to four days before being turned out to pasture or grass traps. Personnel at the Noble Foundation, near Ardmore, Oklahoma, and several Oklahoma cattlemen, have had success weaning calves in the pasture. Electric fence keeps the cows and calves separated. It is suggested that a supplementation program be continued after the calves are turned out to pasture. This trains the calves to feed and assists the producer in monitoring the cattle throughout the program.

In many farm situations and in years of drought, the high quality pasture alternative may not be available.

In these cases, hay coupled with supplementation or concentrate-feeding programs are implemented. The number of nutrition program alternatives is virtually unlimited. Table 7 shows budgets for four different scenarios: hay with a low level of supplement; hay and one percent of body weight feed; free-choice receiving feed; and pasture with supplement. Obviously, feed prices, labor availability, and buyer preferences will have an important influence on these calculations; therefore, these budgets must be viewed only as examples. An OSU designed computer program (OSU Precon) can be used to estimate costs of preconditioning and breakeven sale price for the cattle. This program is available through county Extension offices or can be downloaded through the Internet at www.ansi.okstate.edu.

The nutrition program has a direct influence on cattle fleshiness, fill, future performance, and price. Smith et. al. (2000) found that cattle classified as "full" were discounted $3/cwt to $4/cwt compared to cattle with average fill. Similarly, cattle classified as "fleshy" were discounted one to two dollars per cwt compared to cattle considered to be in average condition (Smith et al., 2000). Previous research has shown that a faster rate of gain during the growing period results in a slower rate of gain during the subsequent grazing or finishing phase. However, if the calves are sold after preconditioning, nutrition programs based largely on hay are seldom profitable. This is because hay is a very expensive energy source when evaluated on a cost per pound of weight gain basis. Slower rates of gain during preconditioning, and minimum nutritional inputs are justified when all or a percentage of ownership will be retained in the cattle. It is recommended that a moderate rate of gain (1.5 to 2 lbs) be targeted in situations where cattle will be sold, concentrate feeds are inexpensive, and labor availability is adequate.

Summary

Bovine respiratory disease costs the beef industry because affected animals have reduced performance, increased cost of production, and reduced carcass quality. Based on the limited data available, preconditioning (defined as the combination of appropriate vaccination, 45-day weaning and balanced nutrition) significantly reduces morbidity and mortality as well as improving weight gain and feed efficiency. Data is not available documenting the potential benefits of preconditioning relative to carcass quality. Further information is needed to better identify the true value of preconditioning programs in different situations. This information is necessary to forecast a realistic price that buyers can pay for preconditioned calves, while allowing cow/calf producers to reap some of the added value. 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.

Table 7. Example budgets of 45-day preconditioning programs with varying feeding management[a]

Item	*Hay and Supplement* [b]	*Hay and 1% of body weight feed* [c]	*Free-choice ration with hay* [d]	*Pasture and supplement* [c]
Costs, $/head				
Interest	6.46	6.58	6.74	6.41
Health products and medicine	8.00	8.00	8.00	8.00
Death loss	2.57	2.57	2.57	2.57
Labor	4.00	6.00	4.00	2.00
Equipment	2.00	3.00	3.00	1.00
Hay	13.50	10.13	3.38	3.38
Feed	7.88	18.23	40.78	6.75
Pasture	0	0	0	10.00
Total	44.40	54.50	68.47	40.10
Breakeven projection				
ADG, lb	1.0	1.60	2.25	1.75
Sale weight, lb	545	572	601	579
Sale price, $/cwt	96.70	94.97	93.26	94.56
Breakeven price, $/cwt	99.89	96.94	94.55	93.32

[a]Hay used in each situation is bermuda, sorghum sudan or cool season species with > 10% protein and > 52% TDN. Value of weight gain beyond 500 lb weaning weight = $0.60 per lb. Sale price assumes no premium for preconditioning calves.
[b]Supplement contains 20% protein and cost is $175 per ton.
[c]Feed contains 14% protein and cost is $150 per ton.
[d]Ration contains 14% protein and cost is $145 per ton.

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 20 cents per copy. 0607