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Benefit-Cost Analysis of Equipment Purchases for Calf Health Management



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Acknowledgments

This work is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch project #OKL02943 under Accession No. 1004522 and by the Agriculture and Food Research Initiative Competitive Grant #2017-68006-26344 from USDA NIFA.

Abstract

Lack of access to cattle handling equipment is sometimes cited as a hindrance to cow-calf producer adoption of recommended calf management practices, although those practices are shown to add market value to calves. We measure correlations between equipment access and adoption along with implementing partial budget analysis to calculate break-evens of equipment purchases for specific practice

implementation. Break-even measures are calculated in number of head and in years for cash- and loan-based purchases across different operation sizes. This is a first step toward quantifying the benefit-cost relationship of cattle handling equipment with calf management practice adoption.

INTRODUCTION

Cow-calf producers strive to wean healthy calves that perform efficiently in later stages of production. Weaning and receiving periods, however, are difficult and stressful for calves. The adoption of calf health management practices on the ranch safeguards health and maximizes performance of calves, preparing them to move to stocker and feeder phases. Basic calf health management practices include a significant pre-marketing weaning period, dehorning, castrating, vaccinating, deworming, and feed bunk training. Preconditioning encompasses bundling these practices together for marketing. Cow-calf producers face many constraints when it comes to the adoption of these practices. For some, that may include limited access to proper cattle handling equipment that facilitates practice adoption, resulting in healthier calves moving through the beef supply chain. Research has shown that cattle buyers are willing to pay premiums for these practices, whether implemented individually or as a bundle (Williams et al., 2012; 2014; Bulut and Lawrence, 2007). When equipment investment can make the difference between practice adoption or non-adoption, partial budgeting estimates of break-even periods or number of head to break-even provides valuable information to producers.

The objectives of this study are to (1) preview producer equipment access and producer calf management practice adoption rates, (2) calculate and analyze correlation coefficients between producer equipment access and adoption of specific calf management practices, and (3) build budgets and implement break-

even analysis of specific cattle handling facilities and equipment relevant for adoption of calf management practices included in the preconditioning bundle, individually and collectively.

DATA AND METHODS

Data pertaining to producer demographics, adoption of specific calf management practices, and access to various types of facilities and equipment used for processing cattle and calves are taken from the 2017 Oklahoma Beef Management and Marketing Survey of Oklahoma beef cattle producers. The survey is conducted on an approximate five-year cycle by beef team members at Oklahoma State University, including faculty in Agricultural Economics and Animal Sciences. The United States Department of Agriculture's (USDA's) National Agricultural Statistics Service assists with implementation. The survey solicits producer information regarding operation characteristics, resource base and facility access, herd and calf management, forage use, marketing choices, and incentives and constraints to adoption of specific practices. Access to facilities and equipment is defined as own, rent/lease, borrow, or none. A total of 1,495 producers responded to the survey from an initial sample of 5,000, resulting in a 30% response rate and a 95% confidence level associated with the data. The sample was specifically drawn to be representative of Oklahoma cattle producers. Of the 1,495 responses, 1,210 had cow-calf operations. Data regarding facility and equipment costs (initial purchase and installation as well as operation) and life expectancies of various types of facilities were obtained from an industry source. Base cattle prices are taken from the Livestock Marketing Information Center's weekly summary of USDA Agricultural Marketing Service (AMS) feeder cattle prices for medium and large number 1 steers at Oklahoma City (LMIC, n.d.). Fall marketing is assumed in the partial budgets.

We use Microsoft Excel's correlation feature (@correl) to calculate correlations between specific equipment access and practice adoption of specific management practices. Partial budgeting scenarios are developed using Excel to simulate the benefits and costs associated with adopting practices that are facilitated by specific cattle handling facilities or equipment. Different scenarios can then be simulated to calculate break-evens across several different dimensions including but not limited to herd size, market premiums associated with various practices, equipment acquisition costs, prevailing interest rates, etc. Feeder calf market premiums for specific management practices are taken from Williams et al. (2012; 2014)

and represent the market value of specific practices as estimated from livestock auction data collected in person by Oklahoma State University at Oklahoma livestock auctions.

RESULTS

Equipment Access

Access to equipment can be through ownership, whether outright or shared, or through borrowing. Producer survey responses in Figure 1 indicate that nearly all producers have access to working pens (91%) and a squeeze chute or headgate (93%). This equipment is considered by most as the necessary minimum for gathering and working cattle. The headgate or a headgate/squeeze chute combination allows producers to work cattle while minimizing the risk of injury to the producer and the cattle. Access to preconditioning pens is far less at approximately 57% of producers. Preconditioning pens allow weaned calves to be separated from their dams while adjusting during the weaning process but without the added stress of leaving the ranch. Only roughly 20% of producers report access to scales or to a calf tilt table. Scales facilitate more precise management of animals, particularly when measuring performance, calculating feed rations, or administering medication. A calf tilt table (sometimes called a calf chute) makes the process of branding, vaccinating, and castrating calves easier and faster.

Practice Adoption

Recommended calf health management practices can improve calf health on the ranch and as the animal moves through the beef supply chain. Figure 2 reports adoption rates for six management practices that are typically bundled to market calves as preconditioned. Preconditioning builds the stress tolerance and immune system of the calf and facilitates a healthy transition to the next phases of production (Lalman and Mourer, 2017). Of the producers surveyed, 45% indicate that they dehorn cattle. However, this number could be misleading regarding the number of horned cattle marketed, since polled genetics are also a form of horn management. The fact that only 49% of producers administer respiratory vaccinations prior to marketing is of concern, given that bovine respiratory disease (BRD) is a major worry as cattle move through the system. Preconditioning can decrease the incidence of BRD by as much as 90% for future owners of calves, which decreases cost by decreasing medical treatments and increasing the production efficiency of animals and ultimately the quality of beef for the final consumer (Lalman and Mourer, 2017).

Weaning periods of at least 45 days also strengthen immune systems, with approximately 63% of producers implementing this practice. Perhaps the other practice commanding the most interest is castration, with 82% of producers indicating that they castrate bull calves prior to marketing. Although castration has one of the highest rates of adoption, the fact that 18% of producers do not castrate bull calves prior to marketing them as feeder calves is troubling. The stress of castration on the animal is greater as calves get older and heavier. Somewhere down the line, someone has to castrate a larger, more dangerous animal while giving up health advantages and efficiencies gained from earlier castration. And the cow-calf producer is leaving \$6 to \$12 per hundredweight on the table by not implementing castration on the ranch (Williams et al., 2012; 2014).

Correlations between equipment access and practice adoption

Table 1 reports correlation coefficients between selected cattle handling equipment and producer adoption of selected calf management practices, based on data from the Oklahoma Beef Management and Marketing Survey. The t-statistics values are reported in parentheses for each correlation value, with statistical significance denoted by asterisks.

The survey asks producers about access to six types of cattle handling equipment, including calf tilt table, scales, loading chute and/or ramp, preconditioning pens, processing pens, and a squeeze chute/headgate. In a separate question, the survey also asks producers about calf management practices implemented on their cattle operation. We specifically examine the correlations of adoption of castration, dehorning, deworming, 45-day weaning, feed bunk training, and respiratory vaccinations with producer access to the equipment listed above.

Although these correlations can indicate the importance of some equipment in adoption of specific practices, we should be clear that the correlations represent only the correlation between access and adoption for those who have access and do adopt. That is, the correlations do not measure whether access to a certain piece of equipment would directly correlate to a producer implementing a practice not previously done. They do, in some sense, provide a measure of the importance producers who are currently implementing a specific practice have placed on equipment relative to that practice.

Nearly all correlations are statistically different from zero. A few correlations of interest are highlighted

in Table 1. Access to preconditioning pens has the highest correlation with implementation of each of the six practices examined here. Recall that these are the practices typically bundled together for marketing calves as preconditioning and even more so for VAC-45 certified preconditioning programs. The highest correlations are with 45-day weaning, respiratory vaccinations, and feed bunk training, with relatively lower correlations with the other practices. This likely reflects the fact that these three practices are implemented over time, as opposed to instant implementation, and preconditioning pens facilitate holding calves for that extended time.

Castration is weakly correlated with calf tilt table access (0.16) and with squeeze chute/headgate access (0.17). In fact, castration is weakly correlated with all six facilities/equipment pieces examined. Although 82% of Oklahoma cattle producers castrate their bull calves, only 19% report access to a calf tilt table. Since castration can be facilitated in various ways, including traditional open field roping of calves, a calf tilt table, a squeeze chute/headgate, or pen and catch, weak correlation with any one piece of equipment is not surprising. Nearly all producers report access to a squeeze chute/headgate, but it is not strongly correlated with any particular practice. The two strongest correlations are with castration (0.17) and feed bunk training (0.19).

Partial Budget Analysis for Equipment Purchases

As producers consider equipment purchases that could make incorporating recommended management practices into their operation's management plan easier, it is important to consider the applicable benefits and costs. We use partial budget analysis to calculate break-even for equipment purchases relevant to the six practices mentioned above. Premiums for adoption and marketing of a specific practice or practice bundle are based on previous research of the market value of various calf management practices at Oklahoma livestock auctions (e.g., Williams et al., 2012; 2014). We use conservative estimates of market premiums to generate conservative benefit estimates. Equipment costs are based on cost estimates from private dealers and are reported in Table 2.

In addition to calculating break-evens for the reported equipment cost, we also calculate break-evens for cost plus 10% and cost minus 10%. The analysis assumes that the additional market value associated with implementing a specific practice is fully assigned to equipment payoff. Equipment break-even is calculated

on a per-head basis as well as on a time-period basis. Break-evens on a time-period basis are calculated using a cash scenario and a borrowing scenario where the borrowing scenario assumes a 5% interest rate.

Partial budgets for purchasing specific equipment to facilitate a specific calf health management practice are calculated for five scenarios. For each budget, the base and alternative scenario are described in the footnotes, as is the assumed premium for the management practice considered. Premium per hundredweight for implementation is reported on the left-hand side as management premium. Changes in management cost (excluding equipment purchase) associated with a specific practice are reflected in the top section of the right-hand side column. The middle section of the right-hand side indicates "Net return from additional management." The bottom section calculates equipment break-even across three equipment cost scenarios in number of head, years to break-even for a cash scenario, and years to break-even for a borrowing scenario based on practice implementation on calves for 20 head, 100 head, and 250 head. The exception is in the case of preconditioning pens, for which scenarios are in terms of 50, 100, and 250 head.

A calf tilt table stabilizes the calf and can be rotated so that the calf is secured safely on its side for implementation of recommended management practices. It is typically designed to be used with cattle weighing 500 pounds or less. The scenario in Figure 3 calculates benefits, costs, and break-evens for castration facilitated by purchase of a calf tilt table. The comparison of management revenue assumes a \$9 premium per hundredweight for castrating a bull calf prior to marketing (Williams et al., 2012; 2014). The comparison of management costs indicates a small increase in labor cost per head for castration. Net return from castration is calculated as \$49.80 per head, as shown in the "Net return from additional management" row. Recall that the partial budget assumes all net returns from castration are used toward equipment payoff. At the base equipment cost of \$2,790, the break-even number of head (i.e., bull calves to castrate) is calculated as 57. For a producer with 20 bull calves to castrate, years to break-even in the cash scenario is 2.85, reflecting nearly three bull calf crops. Larger producers would see a shorter time to break-even with 0.57 years for 100 head of bull calves and 0.23 years for a large producer with 250 bull calves. Both larger-sized scenarios pay for the calf tilt table with less than one calf crop. For the borrowing scenario, years to break-even is slightly higher at 3.09, 0.58, and 0.23, respectively, moving from 20 to 100 to 250 bull calves to castrate. The partial-budget scenario

here examines only break-even related to benefits and costs of castration implementation. Although a calf tilt table can facilitate multiple recommended practices on a calf crop, its use is limited to calves because of equipment size and weight restrictions.

Another piece of equipment that can facilitate castration is a standard squeeze chute. The partial budget for purchasing a squeeze chute to implement castration of bull calves is shown in Figure 4. The premium for castration is again presumed to be \$9 per hundredweight, as shown in the second section of the left-hand column. A small increase in labor cost per head for castration is indicated in the comparison of management costs. The net return from castration in this scenario is identical to the net return from the previous scenario, at \$49.80 per head as shown in net return from additional management. All net returns from castration are used toward equipment payoff. At the base equipment cost of \$5,307, the break-even number of head (i.e., bull calves to castrate) is calculated as 102. For a producer with 20 bull calves to castrate, years to break-even in the cash scenario is 5.10, or slightly more than five calving seasons. Larger producers would see a shorter time to break-even, with 1.02 years for 100 head of bull calves and 0.41 years for a large producer with 250 bull calves. The borrowing scenario years to break-even is slightly higher at 5.98, 1.06, and 0.42, respectively, moving from 20 to 100 to 250 bull calves to castrate. In this scenario, larger producers again are able to pay off the equipment cost in approximately one calving season or less.

The partial budget for a squeeze chute purchase to implement respiratory vaccinations in calves is shown in Figure 5. BRD is the most common illness in beef cattle. Wittum and Perino (1995) found that calves affected by BRD weighed significantly less at weaning than their herd mates and those performance impacts tend to follow the calf through the supply chain. Calves can be vaccinated for the BRD complex effectively as early as two months of age. Two rounds of respiratory vaccinations prior to marketing feeder calves are recommended, with one round early and another round either two to four weeks prior to weaning or at weaning. Respiratory vaccinations have been shown to garner market premiums ranging from approximately \$2 to \$6 per hundredweight (Williams et al., 2012; 2014). We use a conservative estimate of \$2 in the partial budget. Producers can adjust premiums to reflect local market premiums. The comparison of management costs indicates a small increase in labor cost per head, as well as \$5 per head for vaccines and supplies for vaccination implementation. Calves are assumed to have two rounds of respiratory vaccinations. The

net return from additional management (respiratory vaccinations) is calculated as \$5.85 per head. Note that this includes only the benefit from the market premium and does not account for benefits from any reductions in death loss of calves. However, producers can enter historical death loss rates for calves from their own operations in the base scenario and estimate the improved rate in the alternate scenarios. Those values will vary by operation.

At the base squeeze chute cost of \$5,037, the break-even number of head (i.e., number of calves vaccinated) is calculated as 861. Years to break-even for 20 calves under the cash scenario is 43.05 years, but under the borrowing scenario, a vaccination premium of \$2 per hundredweight never pays off the loan. At 100 head and 250 head, the cash break-even period is 8.6 years and 3.4 years, respectively, whereas under the borrowing scenario, those break-even periods are 11.53 years and 3.87 years. Certainly, a squeeze chute can facilitate multiple cattle management practices, including castration and vaccinations, so payoff head and years to break-even could be shorter if net returns to multiple practices are allocated to equipment payoff.

Preconditioning pens can facilitate 45-day weaning by providing a place to hold calves separate from dams during the weaning period. The partial budget in Figure 6 examines the break-even periods for 50-head capacity, 100-head capacity, and 250-head capacity preconditioning pens. Recall that the budget looks only at the benefit and cost of 45-day weaning and not at any potential joint practices that could also be implemented. Here, a conservative estimate of the 45-day weaning premium is \$2 per hundredweight (Williams et al., 2012; 2014). Additional revenue comes from the weight gained during the 45-day period. Costs associated with 45-day weaning include the interest associated with holding calves beyond weaning rather than marketing at weaning, as well as an allowance for death loss, labor, forage, feed, and minerals as seen in the comparison of management costs. Net return to 45-day weaning in this scenario is estimated at \$20.34 per head.

Due to the incremental nature of increasing capacity for preconditioning pens, break-even number of head is calculated separately for each capacity. Break-even number of head by capacity is 227 head for 50-head pens, 404 head for 100-head pens, and 1,111 head for 250-head pens. Years to cash break-even across capacities are similar to each other at 4.54, 4.04, and 4.44 for 50-head, 100-head, and 250-head pens, respectively, with slightly longer break-even periods for the borrowing scenario at 5.25, 4.61, and 5.15 years.

Preconditioning pens can facilitate adoption of the bundle of recommended practices commonly referred to as preconditioning, including castration, dehorning, two rounds of respiratory vaccinations, bunk training, and a minimum of 45-day weaning. The budget in Figure 7 illustrates cost-benefit calculations for purchase of preconditioning pens to facilitate adoption of this bundle. The market premium for preconditioned calves is assumed to be \$10 per hundredweight (Williams et al., 2012; 2014). Note that for steer calves, this is in addition to the premium for castration. In this case, the increase in revenue for preconditioning comes from the combination of the market premium and the value of gain over the 45-day period. Producers who choose to precondition calves do incur higher up-front costs generally, although that cost will differ depending on feed type and source. When the cost of preconditioning is considered, net return from preconditioning management is conservatively estimated at \$50.13 per head. Based on this value, the break-even number of head is 92 for a 50-head pen, 164 for a 100-head pen, and 451 for a 250-head pen. Break-even is slightly less than two calving seasons for all sizes. The exception is when equipment cost is base plus 10%. In that scenario, equipment break-even for 50-head pens is slightly more than two calving seasons, as is the borrowing scenario for 250-head pens.

IMPLICATIONS/CONCLUSIONS

In this study, we report on survey results pertaining to cow-calf producer equipment access and calf management practice adoption rates. We then calculate and analyze correlation coefficients between producer equipment access and adoption of specific calf management practices. Finally, we evaluate break-even cattle numbers needed to cover the costs of obtaining various facility/equipment combinations that would facilitate the implementation of calf management practices that have been shown to garner price premiums (and therefore increase total revenue) at sale time. We also evaluate time to break-even for cash-based and loan-based equipment purchases for different operation sizes.

A large majority of cow/calf producers responding to our survey indicated that they have access to some version of a cattle squeeze chute or headgate, as well as access to working/processing pens. Most also have access to a loading chute or ramp to facilitate loading of cattle for transport. Just over half of the survey respondents indicated they have preconditioning pens. A much smaller percentage of producers (less than 20%) reported having access to scales or a calf

tilt table. With regard to specific calf management practices, a large majority of surveyed producers indicated that they castrate bull calves, deworm, and bunk train calves. More than half reported that they wean calves at least 45 days before selling. Less than half of the respondents indicated that they administer respiratory vaccinations and dehorn. Even though a significant portion of respondents indicated that they utilize at least some of these calf management practices, given the magnitude of price premiums attributed to these practices it seems there is still room for improvement in practice adoption.

We find a statistically significant correlation between the adoption of most of the surveyed calf management practices and access to various facility and equipment components, leading to questions concerning the economic feasibility of acquiring specific facility and equipment that would help facilitate adoption of various calf management practices for representative cow-calf producers. Preconditioning pens, in particular, have a strong correlation with adoption of 45-day weaning, bunk training, and respiratory vaccinations, likely because these practices include a time element that preconditioning pens would facilitate.

Partial budget analysis indicates that the largest net returns for practice adoption are associated with castration and preconditioning, which encompass the entire bundle of practices examined here. Note that for calves marketed as steers rather than bulls, the net returns for preconditioning would be additive to the net returns for castration. The scale of a producer's operation significantly influences break-even periods, with the exception of preconditioning pens. For producers who purchase preconditioning pens in order to precondition their calves, all operation sizes reached break-even within two years or two calving seasons. For other equipment purchases to facilitate practice adoption, larger operations attain break-even at a faster pace than smaller operations.

The preconditioning adoption scenario (i.e., adoption of a bundle of practices) is the only scenario where we examined break-even periods relative to practice bundling. It is true that some equipment is multi-use and, as such, can be used for implementation of multiple calf health management practices and also for management related to other cattle in the operation. The partial budgets here are specifically related to calf management but are useful in evaluating the contribution of equipment to the overall returns to management in an operation. These results are a first step in demonstrating the extent to which a lack of resources (facilities and equipment) could be a constraint for some producers in adopting calf management practices that have long been shown to enhance revenue. The findings also suggest that the acquisition of equipment and facilities can be an economically feasible investment in many instances.

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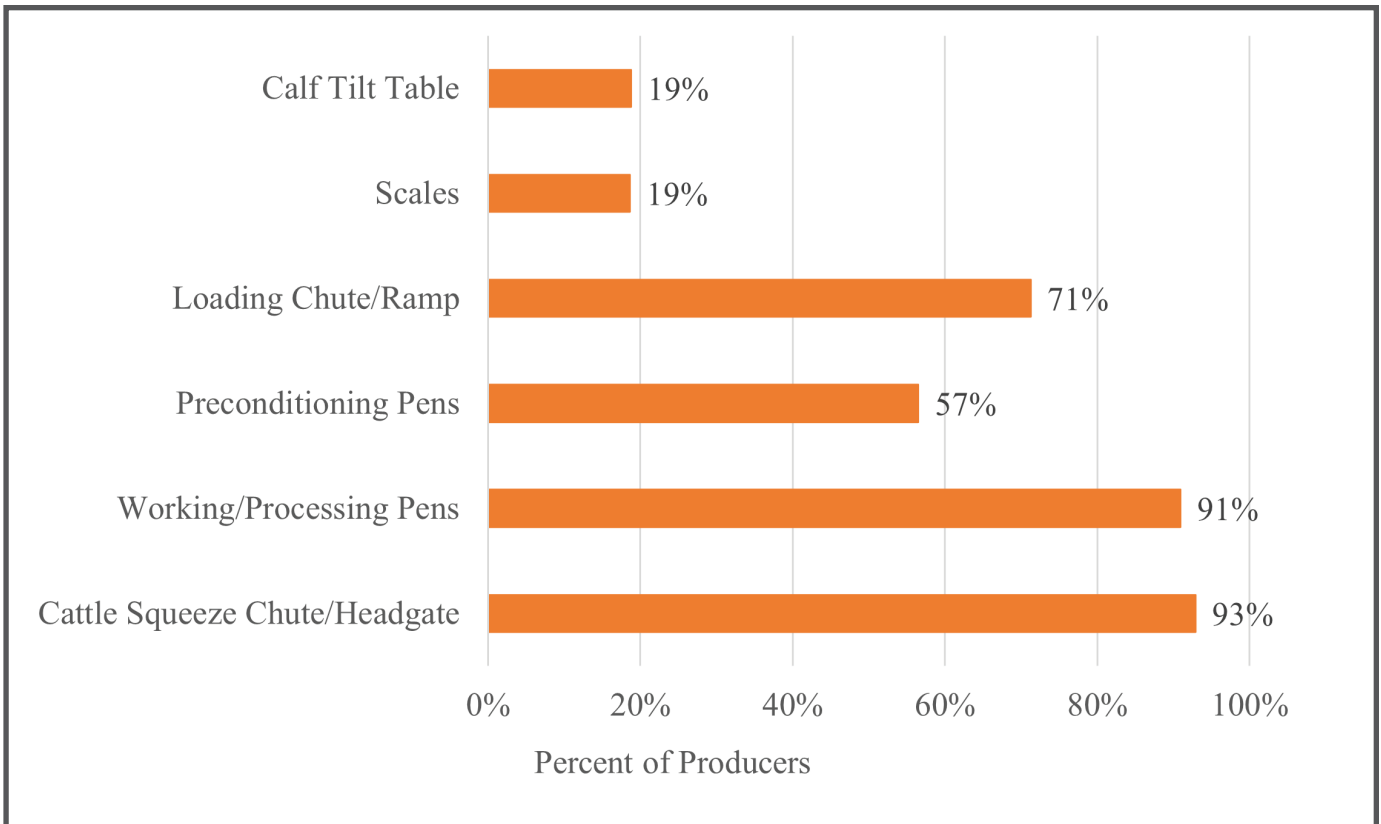


Figure 1. Producer access to cattle facilities and equipment. (Source: 2017 Oklahoma Beef Management and Marketing Survey.)

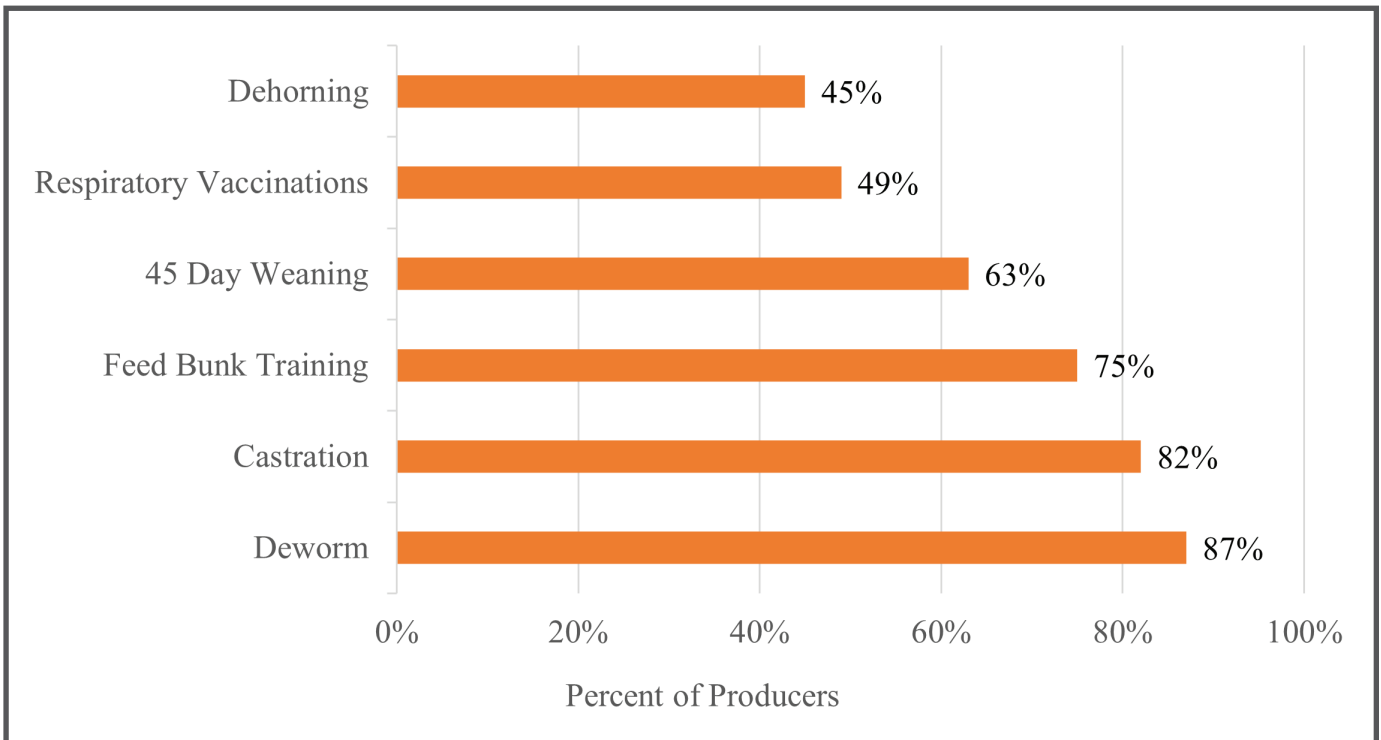


Figure 2. Producer adoption of calf management practices. (Source: 2017 Oklahoma Beef Management and Marketing Survey.)

Partial Budget Calculator - Castration/Calf Tilt Table

Sell at Weaning Revenue	Base	Alternate
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price (\$/cwt.)	146.00	146.00
Gross revenue (\$/head)	814.32	814.32

Comparison of Management Revenues	Base	Alternate
	No Castration	Castration
Management practice		
Days from weaning to marketing	0	0
ADG (lbs./day)	0.00	0.00
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price change from weaning to marketing (\$/cwt.)	0.00	0.00
Estimated price slide (\$/cwt)	0.00	0.00
Calculated price change due to heavier weight (\$/cwt)	0.00	0.00
Price discount for increased flesh (\$/cwt.)		
Management premium (\$/cwt.)	0.00	9.00
Final price (\$/cwt.)	146.00	155.00
Gross revenue (\$/head)	814.32	864.51

Footnotes:
 Base = Market at weaning as bulls
 Alternate = Market at weaning as steers
 Management premium: \$9 premium for castrating and marketing as steers
 Sources: Bulut and Lawrence, 2007; Williams, Raper, DeVuyst, Peel, McKinney, 2012.
 Price source: AMS/USDA Feeder Cattle Prices, Oklahoma City, Weekly, Medium and Large Steers, Fall 2019. Livestock Marketing Information Center.

Comparison of Management Costs	Base	Alternate
	No Castration	Castration
Management practice		
Interest rate (%)	5.0	5.0
Cattle interest (\$/head)	0.00	0.00
Vaccine, health supplies and medicine (\$/head)	0.00	0.00
Death loss (%)		
Death loss (\$/head)	0.00	0.00
Labor (\$/head)	0.00	0.40
Equipment (\$/head)	0.00	0.00
Pasture (\$/head)	0.00	0.00
Fertilizer (\$/head)	0.00	0.00
Hay (\$/head)	0.00	0.00
Feed/supplement (\$/head)	0.00	0.00
Mineral (\$/head)	0.00	0.00
Added marketing costs (tags, commission) (\$/head)	0.00	0.00
Total cost (\$/head)	0.00	0.40

Management Comparison Summary (\$/head)	Base	Alternate
	No Castration	Castration
Management practice		
Sell at weaning gross revenue	\$ 814.32	\$ 814.32
Additional management gross revenue	\$ 814.32	\$ 864.51
Increased revenue	\$ -	\$ 50.20
Less management costs	\$ -	\$ 0.40
Net return from additional management	\$ -	\$ 49.80
Weight gain (lbs.)	0	0
Total cost of gain (\$/cwt)	#DIV/0!	#DIV/0!
Feed cost of gain (\$/cwt)	#DIV/0!	#DIV/0!
Value of gain (\$/cwt)	#DIV/0!	#DIV/0!

Equipment Break-even	Base - 10%	Base	Base + 10%
Calf tilt table cost	\$ 2,511.00	\$ 2,790.00	\$ 3,069.00
Net return from additional management	\$ 49.80	\$ 49.80	\$ 49.80
Break-even point (# head)	51	57	62
Years to break-even: Cash			
20 head	2.55	2.85	3.10
100 head	0.51	0.57	0.62
250 head	0.20	0.23	0.25
Years to break-even: Borrowing (5% interest)			
20 head	2.76	3.09	3.43
100 head	0.52	0.58	0.64
250 head	0.21	0.23	0.25

Figure 3. Partial budget for castration with calf tilt table

Partial Budget Calculator - Castration/Squeeze Chute

	Base	Alternate
Sell at Weaning Revenue		
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price (\$/cwt.)	146.00	146.00
Gross revenue (\$/head)	814.32	814.32

	Base	Alternate
Comparison of Management Revenues		
Management practice	No Castration	Castration
Days from weaning to marketing	0	0
ADG (lbs./day)	0.00	0.00
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price change from weaning to marketing (\$/cwt.)	0.00	0.00
Estimated price slide (\$/cwt)	0.00	0.00
Calculated price change due to heavier weight (\$/cwt)	0.00	0.00
Price discount for increased flesh (\$/cwt.)		
Management premium (\$/cwt.)	0.00	9.00
Final price (\$/cwt.)	146.00	155.00
Gross revenue (\$/head)	814.32	864.51

Footnotes:
 Base = Market at weaning as bulls
 Alternate = Market at weaning as steers
 Management premium: \$9 premium for castrating and marketing as steers
 Sources: Bulut and Lawrence, 2007; Williams, Raper, DeVuyt, Peel, McKinney, 2012.
 Price source: AMS/USDA Feeder Cattle Prices, Oklahoma City, Weekly, Medium and Large Steers, Fall 2019. Livestock Marketing Information Center.

	Base	Alternate
Comparison of Management Costs		
Management practice	No Castration	Castration
Interest rate (%)	5.0	5.0
Cattle interest (\$/head)	0.00	0.00
Vaccine, health supplies and medicine (\$/head)	0.00	0.00
Death loss (%)		
Death loss (\$/head)	0.00	0.00
Labor (\$/head)	0.00	0.40
Equipment (\$/head)	0.00	0.00
Pasture (\$/head)	0.00	0.00
Fertilizer (\$/head)	0.00	0.00
Hay (\$/head)	0.00	0.00
Feed/supplement (\$/head)	0.00	0.00
Mineral (\$/head)	0.00	0.00
Added marketing costs (tags, commission) (\$/head)	0.00	0.00
Total cost (\$/head)	0.00	0.40

	Base	Alternate
Management Comparison Summary (\$/head)		
Management practice	No Castration	Castration
Sell at weaning gross revenue	\$ 814.32	\$ 814.32
Additional management gross revenue	\$ 814.32	\$ 864.51
Increased revenue	\$ -	\$ 50.20
Less management costs	\$ -	\$ 0.40
Net return from additional management	\$ -	\$ 49.80
Weight gain (lbs.)	0	0
Total cost of gain (\$/cwt)	#DIV/0!	#DIV/0!
Feed cost of gain (\$/cwt)	#DIV/0!	#DIV/0!
Value of gain (\$/cwt)	#DIV/0!	#DIV/0!

	Base - 10%	Base	Base + 10%
Equipment Break-even			
Squeeze chute cost	\$ 4,533.30	\$ 5,037.00	\$ 5,540.70
Net return from additional management	\$ 49.80	\$ 49.80	\$ 49.80
Break-even point (# head)	92	102	112
Years to break-even: Cash			
20 head	4.60	5.10	5.60
100 head	0.92	1.02	1.12
250 head	0.37	0.41	0.45
Years to break-even: Borrowing (5% interest)			
20 head	5.29	5.98	6.68
100 head	0.95	1.06	1.17
250 head	0.38	0.42	0.46

Figure 4. Partial budget for castration with squeeze chute

Partial Budget Calculator - Respiratory Vaccinations/Squeeze Chute



	Base	Alternate
Sell at Weaning Revenue		
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price (\$/cwt.)	155.00	155.00
Gross revenue (\$/head)	864.51	864.51

	Base	Alternate
Comparison of Management Revenues		
Management practice	No Vaccinations	Vaccinations
Days from weaning to marketing	0	0
ADG (lbs./day)	0.00	0.00
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price change from weaning to marketing (\$/cwt.)	0.00	0.00
Estimated price slide (\$/cwt)	0.00	0.00
Calculated price change due to heavier weight (\$/cwt)	0.00	0.00
Price discount for increased flesh (\$/cwt.)		
Management premium (\$/cwt.)	0.00	2.00
Final price (\$/cwt.)	155.00	157.00
Gross revenue (\$/head)	864.51	875.67

Footnotes:
 Base = Market at weaning as steers
 Alternate = Market at weaning as steers with respiratory vaccinations
 Management premium: \$2.00 premium for vaccinated calves
 Sources: Bulut and Lawrence, 2007; Williams, Raper, DeVuyst, Peel, McKinney, 2012.
 Price source: AMS/USDA Feeder Cattle Prices, Oklahoma City, Weekly, Medium and Large Steers, Fall 2019. Livestock Marketing Information Center.

	Base	Alternate
Comparison of Management Costs		
Management practice	No Vaccinations	Vaccinations
Interest rate (%)	5.0	5.0
Cattle interest (\$/head)	0.00	0.00
Vaccine, health supplies and medicine (\$/head)	0.00	5.00
Death loss (%)		
Death loss (\$/head)	0.00	0.00
Labor (\$/head)	0.00	0.30
Equipment (\$/head)	0.00	0.00
Pasture (\$/head)	0.00	0.00
Fertilizer (\$/head)	0.00	0.00
Hay (\$/head)	0.00	0.00
Feed/supplement (\$/head)	0.00	0.00
Mineral (\$/head)	0.00	0.00
Added marketing costs (tags, commission) (\$/head)	0.00	0.00
Total cost (\$/head)	0.00	5.30

	Base	Alternate
Management Comparison Summary (\$/head)		
Management practice	No Vaccinations	Vaccinations
Sell at weaning gross revenue	\$ 864.51	\$ 864.51
Additional management gross revenue	\$ 864.51	\$ 875.67
Increased revenue	\$ -	\$ 11.16
Less management costs	\$ -	\$ 5.30
Net return from additional management	\$ -	\$ 5.85
Weight gain (lbs.)	0	0
Total cost of gain (\$/cwt)	#DIV/0!	#DIV/0!
Feed cost of gain (\$/cwt)	#DIV/0!	#DIV/0!
Value of gain (\$/cwt)	#DIV/0!	#DIV/0!

	Base - 10%	Base	Base + 10%
Equipment Break-even			
Squeeze chute cost	\$ 4,533.30	\$ 5,037.00	\$ 5,540.70
Net return from additional management	\$ 5.85	\$ 5.85	\$ 5.85
Break-even point (# head)	775	861	947
Years to break-even: Cash			
20 head	38.75	43.05	47.35
100 head	7.8	8.6	9.5
250 head	3.1	3.4	3.8
Years to break-even: Borrowing (5% interest)			
20 head	#N/A	#N/A	#N/A
100 head	10.03	11.53	13.13
250 head	3.45	3.87	4.30

Figure 5. Partial budget for vaccinations with squeeze chute

Partial Budget Calculator - 45 Day Weaning/Preconditioning Pens



	Base	Alternate
Sell at Weaning Revenue		
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price (\$/cwt.)	155.00	155.00
Gross revenue (\$/head)	864.51	864.51

	Base	Alternate
Comparison of Management Revenue		
Management practice	Sell at Weaning	45-Day Weaning
Days from weaning to marketing	0	45
ADG (lbs./day)	0.00	1.60
Ranch (marketing) weight (lbs.)	575	647
Shrink (%)	3.0	1.0
Sale weight (lbs.)	558	641
Price change from weaning to marketing (\$/cwt.)	0.00	0.00
Estimated price slide (\$/cwt)	0.00	-10.00
Calculated price change due to heavier weight (\$/cwt)	0.00	-8.28
Price discount for increased flesh (\$/cwt.)		
Management premium (\$/cwt.)	0.00	2.00
Final price (\$/cwt.)	155.00	148.72
Gross revenue (\$/head)	864.51	952.61

Footnotes:
 Base = Market at weaning as steers
 Alternate = Market as steers after 45-day weaning
 Management premium: No premium for selling at weaning; \$2.00 45 day weaning premium
 Sources: Bulut and Lawrence, 2007; Williams, Raper, DeVuyst, Peel, McKinney, 2012.
 Price source: AMS/USDA Feeder Cattle Prices, Oklahoma City, Weekly, Medium and Large Steers, Fall 2019. Livestock Marketing Information Center.

	Base	Alternate
Comparison of Management Costs		
Management practice	Sell at Weaning	45-Day Weaning
Interest rate (%)	5.0	5.0
Cattle interest (\$/head)	0.00	5.33
Vaccine, health supplies and medicine (\$/head)	0.00	0.00
Death loss (%)		0.01
Death loss (\$/head)	0.00	0.10
Labor (\$/head)	0.00	10.00
Equipment (\$/head)	0.00	0.00
Pasture (\$/head)	0.00	5.00
Fertilizer (\$/head)	0.00	23.19
Hay (\$/head)	0.00	0.00
Feed/supplement (\$/head)	0.00	19.39
Mineral (\$/head)	0.00	0.75
Added marketing costs (tags, commission) (\$/head)	0.00	4.00
Total cost (\$/head)	0.00	67.75

	Base	Alternate
Management Comparison Summary (\$/head)		
Management practice	Sell at Weaning	45-Day Weaning
Sell at weaning gross revenue	\$ 864.51	\$ 864.51
Additional management gross revenue	\$ 864.51	\$ 952.61
Increased revenue	\$ -	\$ 88.10
Less management costs	\$ -	\$ 67.75
Net return from additional management	\$ -	\$ 20.34
Weight gain (lbs.)	0	83
Total cost of gain (\$/cwt)	#DIV/0!	\$ 81.85
Feed cost of gain (\$/cwt)	#DIV/0!	\$ 58.38
Value of gain (\$/cwt)	#DIV/0!	\$ 106.42

	Base - 10%	Base	Base + 10%
Equipment Break-even			
Preconditioning pens cost (50 head)	\$ 4,140.00	\$ 4,600.00	\$ 5,060.00
Net return from additional management	\$ 20.34	\$ 20.34	\$ 20.34
Break-even point (# head)	204	227	249
Years to break-even: Cash	4.08	4.54	4.98
Years to break-even: Borrowing (5% interest)	4.66	5.25	5.86
Preconditioning pens cost (100 head)	\$ 7,380.00	\$ 8,200.00	\$ 9,020.00
Net return from additional management	\$ 20.34	\$ 20.34	\$ 20.34
Break-even point (# head)	363	404	444
Years to break-even: Cash	3.63	4.04	4.44
Years to break-even: Borrowing (5% interest)	4.10	4.61	5.14
Preconditioning pens cost (250 head)	\$ 20,340.00	\$ 22,600.00	\$ 24,860.00
Net return from additional management	\$ 20.34	\$ 20.34	\$ 20.34
Break-even point (# head)	1000	1111	1223
Years to break-even: Cash	4.00	4.44	4.89
Years to break-even: Borrowing (5% interest)	4.57	5.15	5.74

Figure 6. Partial budget for 45-day weaning with preconditioning pens

Preconditioning Partial Budget Calculator - Preconditioning Pens

	Base	Alternate
Sell at Weaning Revenue		
Ranch (marketing) weight (lbs.)	575	575
Shrink (%)	3.0	3.0
Sale weight (lbs.)	558	558
Price (\$/cwt.)	155.00	155.00
Gross revenue (\$/head)	864.51	864.51

	Base	Alternate
Preconditioning Management Revenue		
Management practice	Sell at Weaning	Preconditioning
Days from weaning to marketing	0	45
ADG (lbs./day)	0.00	1.60
Ranch (marketing) weight (lbs.)	575	647
Shrink (%)	3.0	1.0
Sale weight (lbs.)	558	641
Price change from weaning to marketing (\$/cwt.)	0.00	0.00
Estimated price slide (\$/cwt)	0.00	-10.00
Calculated price change due to heavier weight (\$/cwt)	0.00	-8.28
Price discount for increased flesh (\$/cwt.)		
Management premium (\$/cwt.)		10.00
Final price (\$/cwt.)	155.00	156.72
Gross revenue (\$/head)	864.51	1003.85

Footnotes:
 Base = Market at weaning as bulls
 Alternate = Market as dehorned, vaccinated, and dewormed steers after a 45-day weaning period
 Management premium: \$5.50 premium for preconditioning
 Sources: Bulut and Lawrence, 2007; Williams, Raper, DeVuyst, Peel, McKinney, 2012.
 Price source: AMS/USDA Feeder Cattle Prices, Oklahoma City, Weekly, Medium and Large Steers, Fall 2019. Livestock Marketing Information Center.

	Base	Alternate
Preconditioning Management Costs		
Management practice	Sell at Weaning	Preconditioning
Interest rate (%)	5.0	5.0
Cattle interest (\$/head)	0.00	5.33
Vaccine, health supplies and medicine (\$/head)	0.00	10.75
Death loss (%)		0.01
Death loss (\$/head)	0.00	0.10
Labor (\$/head)	0.00	13.20
Equipment (\$/head)	0.00	7.50
Pasture (\$/head)	0.00	5.00
Fertilizer (\$/head)	0.00	23.19
Hay (\$/head)	0.00	0.00
Feed/supplement (\$/head)	0.00	19.39
Mineral (\$/head)	0.00	0.75
Added marketing costs (tags, commission) (\$/head)	0.00	4.00
Total cost (\$/head)	0.00	89.21

	Base	Alternate
Sell at Weaning vs Preconditioning Summary (\$/head)		
Management practice	Sell at Weaning	Preconditioning
Sell at weaning gross revenue	\$ 864.51	\$ 864.51
Preconditioning gross revenue	\$ 864.51	\$ 1,003.85
Increased revenue	\$ -	\$ 139.34
Less preconditioning costs	\$ -	\$ 89.21
Net return from preconditioning management	\$ -	\$ 50.13
Weight gain (lbs.)	0	83
Total cost of gain (\$/cwt)	#DIV/0!	\$ 107.77
Feed cost of gain (\$/cwt)	#DIV/0!	\$ 58.38
Value of gain (\$/cwt)	#DIV/0!	\$ 168.32

	Base - 10%	Base	Base + 10%
Equipment Break-even			
Preconditioning pens cost (50 head)	\$ 4,140.00	\$ 4,600.00	\$ 5,060.00
Net return from preconditioning management	\$ 50.13	\$ 50.13	\$ 50.13
Break-even point (# head)	83	92	101
Years to break-even: Cash	1.66	1.84	2.02
Years to break-even: Borrowing (5% interest)	1.77	1.97	2.18
Preconditioning pens cost (100 head)	\$ 7,380.00	\$ 8,200.00	\$ 9,020.00
Net return from preconditioning management	\$ 50.13	\$ 50.13	\$ 50.13
Break-even point (# head)	148	164	180
Years to break-even: Cash	1.48	1.64	1.80
Years to break-even: Borrowing (5% interest)	1.57	1.75	1.93
Preconditioning pens cost (250 head)	\$ 20,340.00	\$ 22,600.00	\$ 24,860.00
Net return from preconditioning management	\$ 50.13	\$ 50.13	\$ 50.13
Break-even point (# head)	406	451	496
Years to break-even: Cash	1.62	1.80	1.98
Years to break-even: Borrowing (5% interest)	1.73	1.94	2.14

Figure 7. Partial budget for preconditioning bundle with preconditioning pens

Table 1. Correlation Between Calf Management Practice and Facility/Equipment Access

Facilities/Equipment	Calf Management Practice					
	Castration	Dehorning	≥45-Day Weaning	Respiratory Vaccinations	Deworming	Feed Bunk Training
Calf Tilt Table	0.16*	0.06*	0.00	0.08*	0.04	0.07*
	(5.377)	(2.138)	(0.017)	(2.706)	(1.470)	(2.289)
Scales	0.06*	0.10*	0.12*	0.22*	0.05	0.11*
	(2.020)	(3.282)	(4.166)	(7.640)	(1.545)	(3.666)
Loading Chute/Ramp	0.07*	0.06*	0.11*	0.12*	0.04	0.11*
	(2.471)	(2.074)	(3.685)	(4.272)	(1.290)	(3.719)
Preconditioning Pens	0.18*	0.18*	0.33*	0.31*	0.21*	0.36*
	(6.043)	(6.000)	(11.939)	(11.045)	(7.193)	(12.991)
Processing Pens	0.15*	0.10*	0.12*	0.16*	0.10*	0.21*
	(5.354)	(3.337)	(4.199)	(5.558)	(3.411)	(7.445)
Squeeze Chute/Headgate	0.17*	0.08*	0.06*	0.12*	0.07*	0.19*
	(5.873)	(2.604)	(2.020)	(4.252)	(2.464)	(6.386*)

Note: Values in parentheses are t-statistics.

*Indicates that the correlation value is statistically different from zero with 95% confidence.

Table 2. Estimated Equipment Costs, 2019

Equipment	Estimated Cost (\$)
Calf Tilt Table	2,790
Scales	3,108
Preconditioning Pens (per 50 head)	4,600
Cattle Squeeze Chute/Headgate	5,037