EFFECTS OF PREVIOUS CALF MANAGEMENT ON FEEDLOT AND CARCASS TRAITS

A Thesis

by

BOBBY CLEAVE BINGHAM

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2011

Major Subject: Animal Science

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Approved by:

Chair of Committee,	Chris Skaggs
Committee Members,	Andy Herring
	Chris Boleman
Head of Department,	H. Russell Cross

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ABSTRACT

Effects of Previous Calf Management on Feedlot and Carcass Traits.

(December 2011)

Bobby Cleave Bingham, B.S., Texas A&M University

Chair of Committee: Dr. Chris Skaggs

In 1999-2000, the Texas A&M University Ranch to Rail Program evaluated 1311 steers in two feedlots. The first was the Swisher County Cattle Company in Tulia, Texas and the other was Hondo Creek Cattle Company in Edroy, Texas. Data were collected on several traits, but from this project emphasis was placed on preweaning (PreVac) and postweaning (PosVac) vaccinations and the potential influence on growth and carcass traits. Independent variables used in the analyses were location of the feedyard (LOC), PreVac, PosVac, PreVac*PosVac, LOC* PreVac, LOC*PosVac, LOC* PreVac*PosVac, Ranch of origin (RANCH) nested within LOC* PreVac*PosVac, number of days from weaning to shipping to the feedyard (WNTSHP), and days on feed (DOF). Dependent variables evaluated for live cattle traits were average daily gain (ADG), medicine costs (MED), and initial value upon arriving at the feedyard. Dependent variables evaluated for carcass traits were hot carcass weight (HCW), ribeye area (REA), yield grade (YG), and gross value (GROSS). RANCH ($P < 0.0001$) and DOF ($P < 0.0001$) had large impacts on ADG.

PreVac*PosVac (*P* = 0.0209), LOC*PosVac (*P* = 0.0028), RANCH (*P* < 0.0001), and DOF (*P* = 0.0003) all had significant effects on MED. PreVac (*P* < 0.0001), PreVac*PosVac (*P* < 0.0001), LOC (*P* < 0.0001), LOC* PreVac*PosVac (*P* = 0.0002), RANCH (*P* < 0.0001), and DOF (*P* < 0.0001) all had significant impact on Initial value. RANCH (*P* < 0.0001) was the only significant influence on HCW. LOC (*P* = 0.0587), LOC*PosVac (*P* = 0.0525), LOC*PreVac*PosVac (*P* = 0.0594) all had slightly significant effect on HCW. LOC (*P* < 0.0001) and RANCH (*P* < 0.0001) had a significant effect on REA while DOF (*P* = 0.0535) had slight significant effect. LOC (*P* = 0.0032), RANCH (*P* < 0.0001), and DOF (*P* < 0.0001) had significant impact on YG. RANCH (*P* < 0.0001) had a significant effect and DOF (*P* = 0.0552) had slight significance on GROSS. The data indicate that RANCH and to a lesser extent DOF have the most influence on both feedyard and carcass traits.

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INTRODUCTION

With input costs at all time highs, it is important to evaluate how to produce a quality product in the most efficient manner. The cattle industry is unique in that it has so many producers that are the source of the beef consumed, yet most of the producers will not own the cattle through all phases of the production cycle and will not receive information about the performance of their calves. This results in a variety in the type of cattle that are produced, and also results in diverse management practices that are put into action in different production stages.

The idea of preconditioning has been around for many years. There are many different protocols for preconditioning programs, but all the programs are based on the same principles. One of these principles is vaccination, with primary interest in vaccinating for bovine respiratory disease (BRD). Bovine respiratory disease has a large economic impact on the beef cattle industry. Gardner et al. (1999) reported that animal health and medicine costs are the most important factors impacting animal performance and determining feedlot cattle profitability. With that in mind, the goal of producers is to determine the best solution to combat the incidence of morbidity and mortality which negatively affect returns seen by the producer.

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This thesis follows the style of Journal of Animal Science.

There are many different thoughts to the type of respiratory vaccines to use and when to use them. There are many options for the source of vaccines as well as different types such as modified live, live, and killed. The information in this study was less concerned with the type of vaccine used but more interested in the timing of the vaccine. With so many producers having different management philosophies, the objective was to look at different vaccination protocols to determine an effective solution to provide producers with information on whether respiratory vaccines are something that will result in added returns through the feedlot phase and ultimately on the rail. There has been much research on respiratory vaccines and subsequent impact on feedlot performance, but less information exists on how these vaccines impact carcass traits.

The objectives of this study were to determine if BRD vaccination protocol at the ranch of origin would have an effect of feedlot performance and carcass traits. This study also evaluated preweaning and postweaning vaccination protocols, and their potential interaction. By testing these protocols, answers should be provided as to whether or not vaccination against BRD truly impacts carcass traits. Also, this study investigated vaccination timing and associated importance in the effectiveness of BRD vaccines.

LITERATURE REVIEW

One goal of preconditioning programs is to help promote respiratory disease vaccination. Preconditioning programs have been around for many years, so there have been many studies done to test their effects. Cole (1985) reported preconditioned cattle had a feedlot morbidity rate of 20.4 percent compared to a morbidity rate of 26.5 percent for cattle that were not preconditioned. In this study, preconditioned calves were vaccinated against Parainfluenza-3 (PI-3), Infectious Bovine Rhinotracheitis (IBR), and Bovine Viral Diarrhea (BVD). These calves were vaccinated at weaning, which was 21 days before they were sent to the feedyard. The control calves did not go through any preconditioning programs. These data show that respiratory vaccines as part of the preconditioning program are effective in reducing morbidity. Cravey (1996) reported similar results. In this study, one group of calves went through a preconditioning program, and the other group was from an unknown background purchased through an order buyer. The preconditioned calves had a morbidity rate of 19 percent while the non-preconditioned cattle had a morbidity rate of 62 percent. In addition to this, the preconditioned calves outperformed the other group with a faster rate of gain of 3.00 pounds per day versus 2.80 for non-preconditioned cattle. Medicine costs were $4.33 per animal compared to $34.00 per animal for non-preconditioned cattle. This equated to a much lower cost of gain, and the preconditioned cattle returned $55.93 over the non-preconditioned group. These calves became acclimated to their new environment quicker resulting in faster gain and profit for the feeder. There are many stressors placed on calves as they go into the feedyard. Recent weaning, transporting, commingling, and exposure to a new environment, collectively lower immunity allowing for the onset of BRD. By vaccinating, the immunity level should be elevated allowing the calves to fight off disease, particularly during times of stress.

Preconditioning can also affect growth rate of calves. Pritchard and Mendez (1990) reported that preconditioned calves had a higher ADG, 1.38 compared to 1.22 kg/day, during the receiving period of 56 days. From that point on, it was lower than the non-preconditioned calves. Also, preconditioned cattle were less efficient which caused a higher feed to gain ratio. Lofgreen (1988) reported similar findings. The preconditioned cattle out gained the non-preconditioned group during the receiving period. The preconditioned group gained 2.00 compared to 1.46 lbs/day. The non-preconditioned group had a higher ADG during the finishing period and also had a better feed to gain ratio. The non-preconditioned group had an ADG of 3.03 lbs/day and a feed to gain ratio of 6.61 to 1. The preconditioned group had an ADG of 2.91 lbs/day and a feed to gain ratio of 7.07 to 1. These results could be from compensatory gain of the nonpreconditioned calves after the receiving period. Step et al. (2008) performed a study that differed for the receiving period compared to the studies above. In this study, steers bought through market by an order buyer were compared to steers from a single ranch of origin where they were managed differently. The steers from the ranch of origin were managed in three separate groups. The first group was weaned and sent to the feedyard (WEANED). The second group was backgrounded for 45 days (WEAN45), and the third group was backgrounded for 45 days and vaccinated at weaning and received a booster two weeks later with a modified live viral respiratory vaccine (WEANVAC45). A commingled group was also assembled at the feedyard with calves from market and calves from each of the three groups from the ranch of origin. The results of this study showed that calves from market had the highest average daily gain at 1.29 kg/day during the first 42 days on feed. Steers from the ranch of origin averaged 1.19 kg/day during that time and steers that were commingled averaged 1.10 kg/day. Among the groups from the ranch of origin, WEANED averaged 1.27 kg/day, WEAN45 averaged 1.15 kg/day, and WEANVAC45 averaged 1.00 kg/day during the initial 42 days on feed. Step et al. (2008) did note that the WEANVAC45 were the heaviest upon arrival.

Time of vaccination can also play an important role in the effectiveness of vaccines. Kreikemeier et al. (1997) developed a study to test the importance of vaccination timing. The first group was vaccinated with a killed viral vaccine before weaning and received a booster at the time of weaning. The second group received a modified live viral vaccine after they were weaned, taken to the sale barn, and commingled. The third group received a modified live viral vaccine upon arrival the feedyard. Both group 2 and 3 received a booster 21 days after arriving at the feedyard. Morbidity rates of group 1, group 2, and group 3 were 27, 33, and 37 percent, respectively. In a study by Lofgreen (1988), there were similar results. Group 1 was weaned early, given a nasal vaccine for IBR and PI-3, and backgrounded for 21 days. Group 2 was given the same vaccine at the time of weaning plus long-acting oxytetracycline and sulfadimethoxine but was not backgrounded. Lofgreen (1998) stated that during the 28-day receiving period, there was less morbidity in preconditioned calves that in non-preconditioned calves. Morbidity for group 1 was 15 percent but was 30 percent for group 2. Both the Kreikemeier et al. (1997) and the Lofgreen (1988) studies showed that vaccination timing is essential to optimally reduce morbidity rates. By vaccinating early, the calves have built up enhanced immunity. This should be the primary reason for the lower morbidity rates found in the calves that were vaccinated earlier. Fulton et al. (2002) observed interesting results of feedlot morbidity as it relates to vaccination timing by different ranches in Oklahoma. In the study, the ranches that had the highest morbidity rates had various times of administration. One ranch of origin gave only one vaccination 13 weeks before the delivery date. The other two herds gave the first vaccination 3 weeks before delivery. Of those ranches, one herd was given the second vaccination 1 day before delivery and the other herd was given the vaccination 2 days before delivery. The morbidity rates for these ranches were 75, 77.8, and 60 percent. The ranches experiencing the lowest morbidity rates vaccinated more consistently than the ranches mentioned above.

One herd vaccinated at 7 and 3 weeks before delivery. The next herd gave one vaccination 7 weeks before delivery. The other herd vaccinated at 6 and 4 weeks before delivery. These ranches experienced morbidity rates of 8.3, 0, and 10 percent. This study had a limited sample size associated with each ranch of origin but the results are worth noting. The timing of the vaccines at 6 to 7 weeks before their delivery date proved to be the most effective in the reduction of morbidity in the feedlot for this trial.

Another important aspect of vaccination for BRD is the inclusion of all viruses that could have a large impact on animal health. A study by Hansen et al. (1992) showed that the overall morbidity rate for Bovine Respiratory Syncytial Virus (BRSV) vaccinates was 10.5 percent, and the rate for non-vaccinates was 13.9 percent. In this study, group 1 was vaccinated for BRSV, IBR, PI-3, and BVD. Group 2 received vaccinations for IBR, PI-3, and BVD. All calves received boosters to the initial vaccine. While the morbidity rate of those calves vaccinated without BRSV had a very acceptable rate at 13.9 percent, the reduction in morbidity rate of those calves that received the vaccine including BRSV to 10.5 percent was certainly significant. This demonstrated the importance of vaccination against all viruses that can lead to BRD. This study took place in the Northwest United States. Potentially, these results could be more effective for Northern areas, but from the results, it seemed to be beneficial to vaccinate against BRSV regardless of the location where the cattle are raised or fed.

Vaccinations as part of a preconditioning program appear to be effective but they are not the only thing affecting health. There are many stresses that can reduce immunity. Pinchak et al. (2004) studied how transport can affect health in a stocker program. All calves were vaccinated against IBR, BVD, BRSV, and PI-3 upon arrival and given a booster 14 days later. One group came from Florida and the other from Mississippi, with the experiment occurring in North Texas. Mississippi cattle experienced less morbidity than the Florida group. The associated percentages were 26 and 34, respectively. This showed that the cattle experiencing the shorter trip had less incidence of sickness. In another experiment within that publication, the researchers evaluated the effect of castration of bull calves. Calves where transported from the North, West, and Central Texas, and the same vaccination protocol was followed as in the initial experiment. Pinchak et al. (2004) stated that ADG of morbid bulls castrated after arrival was .19 kg/d less than that of healthy steers, and morbid bulls gained .13 and .14 kg/d less than did healthy bulls and morbid steers, respectively. With healthy bulls gaining the same as morbid steers, the effects of castration are clear. Morbidity for the steers was 33.6 percent and for the bulls was 60.3 percent. Morbidity was certainly elevated for the bulls due to the stresses caused by castration. This study dealt with a stocker program, and both groups of cattle were preconditioned for 28 days. While this study evaluated a stocker scenario, it showed a good representation of how stressors such as transport and castration negatively affect animal performance. These cattle were exposed to a new environment and commingled with calves of a different origin just the same as they would be in a feedyard. Similar results were reported by Step et al. (2008). They saw large differences in morbidity of cattle that were considered high risk. This study was previously mentioned in the text and compared cattle gathered through market, steers from a single ranch of origin managed in 3 different groups, and a group of commingled steers from all 4 groups. The group from the ranch of origin had a morbidity rate of 11.1 percent. The group from market had a rate of 41.9 percent, and the commingled steers had a rate or 22.69 percent. There was also a wide range in morbidity rates for the groups from the ranch of origin. The steers that were weaned and sent to the feedlot had a morbidity rate of 35.1 percent. The steers that were backgrounded for 45 days had a rate of 5.9 percent, and the steers that were backgrounded and received respiratory vaccinations had a rate of 9.5 percent. The high risk groups of steers that were weaned and sent to the feedyard and those gathered at market experienced much higher morbidity while in the feedlot. So whether cattle are sent to a feedyard or a stocker program, they experience stressors that negatively affect their health and, consequently, their performance. The management goal is to reduce those stresses as much as possible at the ranch of origin to result in healthier cattle through the feeding phase.

Morbidity has the most significant impact on feedlot performance and ultimately the profit or loss associated with a calf. McNeill (1999) showed from the Texas Ranch of origin to Rail data that medicine costs averaged $31.97 for sick steers. In that same study, he also reported healthy steers cost of gain was 14 percent lower than that of sick cattle. The cost of gain of healthy cattle was $56.68/cwt, and the cost of gain for sick cattle was $65.96/cwt. Schneider et al. (2009) reported similar carcass values for cattle requiring treatment. In this study, calves that received medical treatment 1, 2, and 3 or more times had reduced carcass values of $23.23, $30.15, and $54.01, respectively. They also analyzed traits separately. Cattle treated 1, 2, and 3 plus times received $15.76, $22.09, and $46.70 less than untreated steers due to differences in ADG. They also looked at BRD impact on quality grade and attributed lower premiums of $7.48, $9.58, and $7.70, respectively, for cattle treated 1, 2, and 3 or more times when compared to untreated cattle.

Obviously, cattle health has a huge impact on profitability. Sick cattle have medicine costs, number of treatments, the labor involved in treatments, and reduced performance, leading to high costs of production so much so that morbidity has a bigger economic impact than mortality, based on average industry values. An important issue in dealing with BRD is to realize the time it is most likely to occur. Approximately 65 to 80 percent of total morbidity within a feeding period occurred during the first 45 days; this is the primary time for respiratory disease (Smith, 1998). Smith (1998) also noted that morbidity was less than one third this rate after 45 days in the feedlot. Schneider et al (2009) also reported a similar timeline. Their study evaluated at 5,976 cattle during the feeding phase. The reported average day of the first treatment was day 40 after entering the feedlot and 75 percent of cattle treated received it by day 55. One way to address this issue is to vaccinate calves against BRD as well as backgrounding cattle before they enter the feedlot. Step et al. (2008) reported the health care cost per steer for a group of steers that were weaned and shipped to the feedlot and a group gathered through auction was $13.39. This is compared a group that was backgrounded for 45 days and a group that was backgrounded for 45 days and received a respiratory vaccine whose average cost per steer was $8.62. This study confirmed that backgrounding cattle is an effective tool in reducing morbidity in the feedlot as well.

Bovine respiratory disease and its effects on feedlot performance and carcass traits are of great interest for obvious reasons. Bovine respiratory disease has a huge impact on feedlot profitability so the concerns on the potential carcass effects are great in a time where grid pricing and branded beef programs offer premiums for quality carcasses. In a study done by Gardner et al. (1999), all calves were vaccinated against IBR, BVD and BRSV upon arrival to the feedlot. They also received a booster which included PI-3 at three different times. All of these calves originated from the same ranch of origin and were managed on the same vaccination protocol. This allowed for a true representation of the differences among calves requiring treatment and those that did not. Gardner et al. (1999) reported that steers clinically diagnosed with undifferentiated bovine respiratory disease during the finishing phase had lower

ADG than untreated steers. Treated steers had an ADG of 1.47 kg/d compared to untreated steers whose ADG was 1.53 kg/d. To evaluate more closely, steers treated once gained .14 kg/d faster than steers that were treated more than once. In terms of carcass data, untreated steers were fatter and had larger longissimus muscle area. The average fat thickness for steers treated 0, 1, and more than once was 1.17, 1.09, and .76 cm, and the longissimus muscle area was 86.0, 85.0, and 82.5 cm^2, respectively. For steers not treated and treated only once, they had a higher percentage grade Choice and Select. Also, treated steers had more carcasses grade Standard, but the means for quality grade were not statistically significantly different. The values for the percent that graded Choice from the groups that were treated 0, 1, and more than once was 4.9, 4.5, and 0 percent, Select was 82.4, 83.2, and 76.9, and percent Standard was 12.8, 12.4, and 23.1, respectively. From the data presented in this study, it is easy to see that steers not requiring treatment performed better, and steers treated only once were comparable in carcass characteristics. In a five year study of the Texas Ranch to Rail data, McNeill (1999) reported similar results. Healthy calves graded 39 percent Choice. Sick steers had 29 percent of their carcasses grade choice and had 7 percent more carcasses grade Select. Also, healthy steers had fewer grade Standard by 3 percent. This study represented over 12,000 steers so it serves as a very good indicator of the impact of health on carcass traits. Schneider et al. (2009) reported similar findings. In their study, cattle never treated graded choice or better 71 percent of the time. Cattle that were treated 1, 2, and 3 or more times only graded choice 57, 55, and 52 percent, respectively. Increasing evidence indicates BRD and possibly other diseases of feedlot cattle can have detrimental affects on carcass weight, longissimus muscle area, marbling, and potentially tenderness (Larson, 2005). The reduction in the incidence of BRD should not only impact cattle performance and reduction in costs associated with sick animals but also improve the quality of the carcasses produced.

Preconditioning effects on carcass traits has yet to be studied extensively but could hold the answer to the effectiveness of preconditioning programs. A study conducted by Roeber et al. (2000) compared 2 groups of preconditioned calves against a group of cattle with an unknown background that were bought through the sale barn. One preconditioned group had a ribeye area mean value of 14.62 in^2 and that was significantly larger than the other preconditioned group and the group of an unknown background with 13.82 and14.02 in^2, respectively. All the other carcass parameters were similar. The dramatic difference in this study was the morbidity rate. The preconditioned groups had rates of 34.7 and 36.7 percent, respectively. The group of unknown origin had a morbidity rate of 77.3 percent. The preconditioned groups also required far fewer treatments. One preconditioned group required .55 average trips per animal to the hospital and the other was comparable at .70. The group of unknown origin had 1.97 average trips per animal to the hospital. These numbers represent the average number of times that an animal from respective groups required a trip to the sick pen to receive treatment. These values are certainly important when medicine costs are considered. Pritchard and Mendez (1990) reported contrasting results. The preconditioned group was vaccinated against IBR, BVD, and PI-3 3 weeks before weaning. They were then backgrounded for 25-30 days after weaning. The non-preconditioned group received the same vaccination upon arrival at the feedyard. Pritchard and Mendez (1990) stated no carcass differences were observed due to preshipment management, diet or days on feed were noted. They evaluated carcass traits of rib fat, ribeye area, carcass weight and marbling score. The study by Step et al. (2008) observed similar results. They reported no statistical difference between the groups for hot carcass weight and USDA quality grade. However, a difference existed for yield grade. The steers purchased through an order buyer had a yield grade of 2.10. Of the group from the ranch of origin, those that were weaned and sent to the feedyard had a yield grade of 2.77. The other groups from the ranch of origin were those that were backgrounded for 45 days and those that were backgrounded for 45 days and received respiratory vaccinations had yield grade values of 2.33 and 2.44, respectively. These studies demonstrated preconditioning to be effective in reducing morbidity but resulted in minimal differences in carcass traits. More work needs to be conducted in this area to truly determine the effect of preconditioning on carcass traits.

Proper identification and treatment of cattle with BRD symptoms is of the upmost importance. There is increasing evidence showing that there are many calves that either had infection before entering the feedyard, were not diagnosed during the feeding phase, or had subclinical infections. This is evident with the high number of lung lesions present at slaughter as reported in the following studies. Wittum et al. (1996) reported in a study of 469 steers, which were tracked from birth to slaughter, that 72 percent of all steers had pulmonary lesions. Only 35 percent of steers in the study were treated between birth and slaughter for respiratory tract disease. Eight percent of steers received treatment prior to weaning and 29 percent were treated during the feeding period. Only 2 percent were treated both prior to weaning and during the feeding phase. Of the cattle that had lesions at slaughter, 78 percent of all treated steers had lesions and 68 percent of all non treated steers had lesions. Twenty-seven percent of all steers in the population were treated for respiratory tract disease and had lesions present at slaughter. Wittum et al. (1996) also reported that pulmonary lesions evident at slaughter were associated with a 0.076 kg reduction in mean daily gain during the feeding period. After adjustment for pulmonary lesions, they concluded that treatment for respiratory tract disease was not associated with mean average daily gains and that the effect of pulmonary lesions on mean daily gain was not different between calves that had been clinically infected and those that were not. Schneider et al. (2009) reported similar values in terms of lung lesions present in their representative population with an observed percentage of 61.9 percent. Lung lesions were found in 60.6 percent of cattle that were never treated for BRD. Lesions were observed in 74 percent of cattle that had been treated at least once. They estimated overall BRD incidence at a rate of 64.4 percent which is much greater than the 8.17 percent of the cattle that were treated for BRD. Schneider et al (2009) analysis showed that lesion presence had no significant effect on performance traits or carcass traits. However, they used a rating system to determine the severity of lung lesions and the lesion rating had significant effect of on-test ADG, overall ADG, and final bodyweight. There were no differences for scores of 0, 1, 2, 3 or 4, but 5, which represents presence of active bronchial lymph nodes, resulted in detection of significant differences. They were also differences for HCW for lungs that had active bronchial lymph nodes and those that did not. There studies illustrate that diagnosis of BRD can be challenging. Duff and Galyean (2007) stated our ability to diagnose BRD is less than optimal, and development of cost effective, quantitative methods to more accurately detect animals afflicted with or likely to develop BRD would be valuable to the beef industry. The high presence of lung lesion in the studies indicated the wide spread problem with BRD not only on a clinical level but also on a subclinical level.

Preconditioning has been shown to be effective in helping calves transition to the feedyard, but it does require extra inputs and time. Ultimately, widespread adoption of the practice rests with how much extra premiums producers can receive for their efforts. Dhuyvetter et al. (2005) estimated that the economic value of preconditioning is in the range of $40 to $60 per head when finishing cattle. Avent et al. (2004) used data from three consecutive day sales. Two were special preconditioned sales and the third was a regular public auction. They reported that the model found a price premium of $3.30/cwt. for one of the two preconditioning programs and $1.94/cwt. for the other, both of which were compared to the weekly auction. They also went on the report that Texas Cattle Feeder Association feedyard managers have indicated that preconditioned calves are worth $5.25/cwt. more on average than non-preconditioned calves. Thrift and Thrift (2011) reported that preconditioning has demonstrated to the effective in reducing the incidence of BRD and the stocker and feeder phases of production are the greatest benefactors. They also stated that the monetary benefit cow-calf producers realize from preconditioning appears to be quite variable. There is evidence to illustrate the merit of the program, but producers will have to seek out alternative marketing strategies to capture the extra premiums associated with preconditioning. Small producers simply do not have enough calves to be able to market on their own. Special preconditioned sales or an alliance among several producers would be required to not only recover their cost for the program but also receive the extra premiums for their product. Thrift and Thrift (2011) stated that in a competitive bidding situation, buyers pay no more for a group of calves than what another buyer forces them to pay. Breeders will have to establish a reputation for producing quality cattle and find an effective marketing strategy to be able to command the premiums that they desire.

One of the major factors in preconditioning is the inputs associated with backgrounding. There is no doubt that feed costs are high and producers must efficiently be able to add weight to their calves to realize a profit from their preconditioning efforts. Mathis et al. (2009) performed a study in which they evaluated calves on self fed pellets (high input group) to calves hand fed range cubes 3 times per week (low input group). Both groups were run on native grasses in New Mexico where crude protein analysis of clipped forage samples were 6.0 ± 1.28 percent in September and 4.6 ± 0.62 percent in November. The high input calves were 19 kg heavier than those that were fed range cubes at the end of the study. Although they gained more, the extra cost of feed resulted in the low input calves to receiving $20.54 more in net income for the preconditioning phase. These calves were tracked through the feedlot and the low input group had a morbidity rate of 24.6 percent and the high input group had a rate of 7.9 percent. Mathis et al. (2009) stated net income differences in the finishing phase were not statistically significant. The numerical advantage in profitability among high input steers during the finishing phase compensated for the net income advantage of low input steers during the preconditioning phase. They also suggested that steers provided with a higher plane of nutrition in a pasture setting may be more able to cope with the immune challenges associated with shipping to the feedlot. Mathis et al. (2008) conducted a similar study to the one listed above. The difference was the high input calves were fed in a dry lot. The morbidity rate through the feeding phase was 34.3 for the low input group and 47.6 for the high input group. These two studies indicated there may be some advantages to backgrounding on pasture as it relates to feedyard health. St. Louis et al. (2003) compared preconditioning on ryegrass pastures to two different rations fed in a drylot. The average daily gain was 1.33 kg on pasture, 0.84 for dry lot 1 and 0.89 for drylot 2. The net profit was $46.38 for ryegrass, $3.21 for dry lot 1 and $18.25 for drylot 2. The feed for drylot 1 cost $197 per ton and drylot 2 cost $205 per ton. Consumption was much higher in drylot 1 and feed to gain ratio was lower resulting in the lower net return. The net returns indicate that preconditioning in a pasture is an economically viable option. Comparing the two studies, the ryegrass pastures offered a much higher plane of nutrition which resulted in better performance than supplementing on native grasses. Preconditioning in pastures may offer greater returns for producers as long as the forage is of high enough quality.

The literature showed that preconditioning can be important as cattle leave the ranch and enter the feeding phase. There are performance, health, and carcass benefits from preconditioned cattle. The objective of this study was to look at the timing of respiratory vaccines to determine their impact on feedlot performance and carcass traits. In this study, preweaning vaccination, postweaning vaccination, a combination of the two, or no vaccination were evaluated to test their impact on the traits measured.

MATERIALS AND METHODS

Data were used for this study from the 1999-2000 Texas A&M University Ranch to Rail Program. Depending on location of the producer, the steers were fed out at one of two feedlots. One group went to Swisher County Cattle Company in Tulia, Texas (North) and the other group went to Hondo Creek Cattle Company in Edroy, Texas (South). Upon entering the feedlot, each steer was weighed and processed and received an eartag for identification. Each steer was given a per hundred weight value based on current market conditions to determine their initial value. They were sorted in to groups based on weight, frame, condition, and breed type. The cattle in the program were managed the same as all of the other cattle in the feedyard. They received the same ration, processing, and medicine treatment. The diagnosis of sickness was performed by feedyard staff under the same managerial guidelines used for all other cattle in the feedyard.

Steers were marketed when they reached an acceptable weight and fat thickness in accordance with current industry trends. The final sale weight which was used in the calculation of feedlot performance was determined by live weight minus a 4% pencil shrink. The cattle were sold on a carcass basis with premiums and discounts for quality grade, yield grade, and carcass weight.

The categorical data from the information sheets filled out by the producers were put into a workable spreadsheet. All weights, performance information, and carcass information were taken as a part of the Ranch to Rail program when cattle were delivered to the feedlot. The data were modified in several ways. First, cattle that died during the trial were removed from the data set; consequently, 18 steers were removed due to death. Steers that had incomplete data for either days on feed or weaning to shipping days were also removed. There were 1311 steers that entered the program. Data were used on 1265 calves for statistical analysis. Also, there was no distinction made for type of vaccine used. Producers indicated whether they used live, modified live, or killed vaccines, and the data were converted to simply whether they did or did not receive respiratory vaccines. There is some variance in the number of observations for individual traits. This is due to incomplete information collected on some animals at various stages during the feeding and harvesting phase.

The SAS (Statistical Analysis Software, Inc., Cary, NC) program was used for the statistical analyses. The frequency procedure (PROC FREQ) was used to determine the distribution of preweaning vaccination and post weaning vaccination, preweaning vaccination and medicine treatment at the feedyard and postweaning vaccination and medicine treatment at the feedyard. The PROC FREQ was also used to determine the distribution of preweaning vaccination and quality grade, postweaning vaccination and quality grade, and medicine treatment at the feedyard and quality grade.

The general linear model procedure (PROC GLM) in SAS was used to analyze dependent variables of average daily gain (ADG), medicine cost, initial value arriving at the feedyard in the analyses of live cattle traits, and hot carcass weight (HCW), ribeye area (REA), yield grade (YG), and gross value (GROSS) were dependent variables in the analyses of carcass traits. The independent variables were location of the feedyard, preweaning vaccination, postweaning vaccination, preweaning vaccination, postweaning vaccination, location of the feedyard x preweaning vaccination, location of the feedyard x postweaning vaccination, location of the feedyard x preweaning vaccination x postweaning vaccination, ranch of origin nested within location of the feedyard x preweaning vaccination x postweaning vaccination, number of days from weaning to shipping to the feedyard, and days on feed (DOF).

The correlation procedure (CORR) in SAS was used to determine the correlation of ADG, HCW, REA, medicine costs, YG, GROSS, Initial value, days from weaning to shipping, and DOF at the different locations of the feedyard. For all analyses, the level of significance was set at $P < 0.05$.

RESULTS AND DISCUSSION

General Statistical Summaries

The simple means and variation for traits of interest are listed in Table 1. There were differences in the number of observations for each trait due to incomplete data presented for the steers. The ADG was 1.40 kilograms (kg) with a standard deviation (STD DEV) of 0.24. The minimum and maximum values were 0.26 and 2.03 kg, respectively. The mean for hot carcass weight (HCW) was 364.95 kg with a STD DEV of 35.01, while the minimum was 237.68 kg and the maximum value was 494.87 kg. The mean ribeye area (REA) was 89.85 centimeters squared (cm^2). The STD DEV was 11.48 and the minimum and maximum values were 51.60 and 130.29 cm^2, respectively. The medicine cost mean was $4.27 with a STD DEV of $11.58. The minimum and maximum values were $0.00 and $120.50. The GROSS mean was $595.46 with a STD DEV of $117.09. The minimum value was -$35.06 and the maximum was $961.18. The initial value mean was $460.98. The STD DEV was $59.95, the minimum was $280.46 and the maximum was $657.75. The weaning to shipping mean number of days was 67.61 and the STD DEV was 45.80. The minimum was 0.00 and the maximum was 197.00. The mean for days on feed (DOF) was 201.12 and the STD DEV was 31.62. Finally, the minimum was 45 and the maximum was 267 days.

Table 1. Simple means for traits of interest

	Number of observations	Means	Std. dev.	Minimum	Maximum
ADG[a]	1218	1.40 kg	0.24	0.26	2.03
HCW[b]	1207	364.95 kg	35.01	237.68	494.87
REA[c]	1196	89.85 cm²	11.48	51.60	130.29
Medicine cost	1225	$4.27	11.58	0	120.50
YG[d]	1201	2.74	1.00	0	8.20
GROSS[e]	1225	$595.46	117.09	-35.06	961.18
In value	1225	$460.98	59.95	280.46	657.75
Days from shipping to weaning	1225	67.61	45.80	0	197
DOF[f]	1225	201.12	31.62	45.00	267.00

[a] Average Daily Gain
[b] Hot carcass weight
[c] Ribeye area
[d] Yield grade (formula calculation without adjustment)
[e] Gross value
[f] Days on feed

A Chi-square test was performed to test the distribution patterns of the respective populations. The first was performed for preweaning and postweaning vaccinations. The Chi-square value was 43.29, and the *P*-value was < 0.0001 (Table 2). The number of calves receiving no preweaning vaccination and no postweaning vaccination at the ranch was 112 and was 9.14 percent of the population. The number receiving no preweaning vaccination but received a postweaning vaccination was 587 and was 47.92 percent of the population. The number of steers that received a preweaning vaccination but no postweaning vaccination was 22 and represented 1.80 percent of the population. Steers that received both vaccinations were 504 and that was 41.14 percent of the population. The percentage for steers that received at least one of the vaccinations was 90.86 percent. The *P*-value indicates the data were not equally distributed for preweaning and postweaning vaccination combinations.

Table 2. Distribution of preweaning and postweaning vaccination combinations[a]

Preweaning vaccination	Postweaning vaccination No	Yes	Total
No	112	587	699
Yes	22	504	526
Total	134	1091	1225

[a] Chi-square = 43.29, P < 0.0001

The second distribution analysis was performed on preweaning vaccination and medicine cost. The Chi-square was 4.97 and the *P*-value was 0.0258 (Table 3). The number of steers that received no preweaning vaccination and were not treated at the feedyard was 570. Those receiving no preweaning vaccination and were treated at the feedyard were 129. Four hundred and fifty-four steers received a preweaning vaccination but no treatment, and 72 had a preweaning vaccination and were treated at the feedyard. The percentage of steers that did not receive a preweaning vaccination was 57.06, and 42.94 percent of the steers in the trial received a preweaning vaccination. The overall morbidity rate for steers in this trial was 16.4 percent. Steers that received a preweaning vaccination had a morbidity rate of 13.69 percent and steers that did not receive a preweaning vaccination had a morbidity rate of 18.45 percent.

Table 3. Distribution of preweaning vaccination and medicine treatment at the feedyard[a]

	Treated		
Preweaning vaccination	No	Yes	Total
No	570	129	699
Yes	454	72	526
Total	1024	201	1225

[a] Chi-square = 4.97, P = 0.0258

The Chi-squared value for postweaning vaccination and medicine treatment at the feedyard was 0.9839 with a *P*-value of 0.3212 (Table 4). The number of steers receiving no postweaning vaccination and were not treated at the feedyard was 108, and the number of steers with no postweaning vaccination and received a treatment was 25. Nine hundred sixteen steers received a postweaning vaccination but did not receive medicine treatment at the feedyard. One hundred seventy five steers did receive both postweaning vaccination and were treated at the feedyard. Steers that did not receive a postweaning vaccination represented only 10.94 percent of the population compared to 89.06 percent for steers that did receive a postweaning vaccination. The morbidity rate for steers not receiving a postweaning vaccination was 18.66 percent. It was 16.04 percent for those steers that did receive a postweaning vaccination. The *P*-value (*P* = 0.3212) shows that the frequencies did not differ. There was a reduction in morbidity associated with BRD vaccination. The largest difference was seen for cattle that received a preweaning vaccination compared to those cattle that did not.

Table 4. Distribution of postweaning vaccination and medicine treatment at the feedyard[a]

Postweaning vaccination	Treated No	Yes	Total
No	108	25	134
Yes	916	175	1091
Total	1024	201	1225

[a] Chi-square = 0.9839, P = 0.3212

Analysis of Variance

Average daily gain (ADG). Calfhood vaccination protocols were found to have no impact on ADG. The *P*-values for preweaning vaccination, postweaning vaccination, and preweaning vaccination x postweaning vaccination were 0.9817, 0.4452, and 0.5260, respectively (Table 5). The least squares means for ADG for calves receiving only a preweaning vaccination was 1.32 ± 0.10 kg, while it was 1.40 ± 0.01 kg for postweaning vaccination (Table 6). The value for calves receiving both preweaning vaccination and postweaning vaccination was 1.42 ± 0.02 kg, and those receiving neither were 1.35 ± 0.08 kg. While the vaccination protocols had no statistically significant impact of ADG, previous research has shown that calves that are backgrounded have had lower ADG in the feedlot. The levels of significance for location of the feedyard, preweaning vaccination x location of the feedyard, postweaning vaccination x location of the feedyard, preweaning vaccination x postweaning vaccination x location of the feedyard, and days from weaning to shipping were 0.1429, 0.1442, 0.1436, 0.1274, and 0.8482, respectively. Ranch of origin ($P < 0.0001$) and DOF ($P < 0.0001$) demonstrated a significant impact on ADG. However, the purpose of this study was not to study the differences between ranches of origin. It can be assumed that a ranch of origin's management practices will affect these data. Days on feed impact on ADG is certainly expected because of positive correlation among traits.

Table 5. Levels of significance for analysis of variance for live cattle traits

	Average daily gain	Medicine costs	In value
Preweaning vaccination	0.9817	0.0182	< 0.0001
Postweaning vaccination	0.4452	0.0753	0.7633
Preweaning x Postweaning vaccination	0.5260	0.0209	< 0.0001
Location of the feedyard	0.1429	0.5828	< 0.0001
Preweaning vaccination x Location of the feedyard	0.1442	0.7929	0.2788
Postweaning vaccination x Location of the feedyard	0.1436	0.0028	0.7814
Preweaning x Postweaning vaccinations x Location of the feedyard	0.1274	0.7076	0.0002
Ranch of origin	< 0.0001	< 0.0001	< 0.0001
Days from weaning to shipping	0.8482	0.1172	0.1248
Days on feed	< 0.0001	0.0003	< 0.0001

Table 6. Least squares means for vaccination protocol combinations

	Preweaning vaccination only	Postweaning vaccination only	Both	Neither
ADG[a]	1.32 ± 0.10 kg	1.40 ± 0.01kg	1.42 ± 0.02 kg	1.35 ± 0.08 kg
HCW[b]	372.92 ± 15.59 kg	364.09 ± 1.54 kg	364.52 ± 2.69 kg	378.30 ± 11.40 kg
REA[c]	88.82 ± 4.84 cm²	89.66 ± 0.45 cm²	90.24 ± 0.84 cm²	88.49 ± 3.55 cm²
YG[d]	2.95 ± 0.44	2.77 ± 0.04	2.65 ± 0.08	2.98 ± 0.32
Medicine cost	-$6.65 ± 5.19	$5.11 ± 0.51	$5.32 ± 0.89	$0.87 ± 3.80
DOF[e]	193.14 ± 13.97	206.48 ± 30.86	194.26 ± 31.04	205.49 ± 34.53
Initial value	$446.38 ± 17.51	$460.75 ± 1.72	$463.83 ± 3.00	$489.39 ± 12.81
GROSS[f]	$631.66 ± 53.65	$588.59 ± 5.26	$597.40 ± 9.20	$622.66 ± 39.25

[a] Average Daily Gain
[b] Hot carcass weight
[c] Ribeye area
[d] Yield grade
[e] Days on feed
[f] Gross value

Medicine cost. Preweaning vaccination had significant effect on medicine cost with a *P*-value of 0.0182 (Table 5). The LSM for medicine cost and calves receiving preweaning vaccination only was -$6.65 ± 5.19 (Table 6). Without question, this was the lowest value for the vaccination protocols, and supports previous research by Lofgreen (1988), Kreikemeier et al. (1997) and Fulton et al. (2002) that preweaning vaccination can lead to reduced morbidity in the feedlot. The LSM for preweaning represents a $7.52 lower cost compared to the next lowest value, and it is $11.97 lower than the preweaning x postweaning LSM, which is the only other value of significance at 0.0209. The level of significance for postweaning vaccination was 0.0753 (Table 5). Vaccination protocols all have impact on medicine costs with postweaning vaccination being only slightly significant. Postweaning vaccination and preweaning vaccination x postweaning vaccination have LSM values of $5.11 ± 0.51 and $5.32 ± 0.89. The surprising value is that the LSM for calves that didn't receive any calfhood respiratory vaccinations was $0.87 ± 3.80. Location of the feedyard, preweaning vaccination x location of the feedyard, preweaning vaccination x postweaning vaccination x location of the feedyard, and days from weaning to shipping had no significant difference with *P*-values of 0.5828, 0.7929, and 0.7076, and 0.1172, respectively. The value for weaning to shipping differs from expectation. There is increasing evidence to support the number of days backgrounded and its role in helping to reduce morbidity as evidenced by Cravey (1996) and Cole (1985). Once again, ranch of origin and DOF had impact on medicine costs.

The level of significance for ranch of origin was *P* < 0.0001 and DOF was *P* = 0.0003. The same assumptions for ranch of origin can be made as in ADG. The calves with the lowest DOF, we would assume, had the least incidence of sickness which would explain the effects on medicine costs

Initial value. Preweaning vaccination, preweaning vaccination x postweaning vaccination, location of the feedyard, preweaning vaccination x postweaning vaccination x location of the feedyard, ranch of origin, and DOF all had significant effect on initial value (*P* < 0.001). As before we will ignore the effect associated with ranch of origin. Location of the feedyard by itself and its interaction with preweaning vaccination x postweaning vaccination have significant impact on initial value. Part of this may be explained by the ranch of origin's effect on the cattle entering in the North and South feedyard based on breed composition and management. Days on feed impact can be attributed to those cattle that performed better at the ranch of origin and were heavier resulting in a higher initial value, since weight is a large determining factor in the calculation of Initial value. The significance of preweaning vaccination and preweaning vaccination x postweaning vaccination (*P* < 0.001) should be noted as well as that of postweaning vaccination (*P* = 0.7633). The LSM for the different protocols showed interesting effects. The LSM for initial value associated with preweaning vaccination, postweaning vaccination, both, and neither were $446.38 ±12.51, $460.75 ± 1.72, $463.83 ± 3.00, and $489.39 ± 12.81 (Table 7), respectively. It goes against expectations that preweaning vaccination was well below the initial value for postweaning vaccination and those that received both vaccinations, and that the calves that received neither were well above. Postweaning vaccination, preweaning vaccination x location of the feedyard, postweaning vaccination x location of the feedyard, and days from shipping to weaning had no significant effect on initial value (Table 5).

Hot carcass weight (HCW). Only ranch of origin had a significant impact on HCW ($P < 0.001$). The P-values for preweaning vaccination, postweaning vaccination and preweaning vaccination x postweaning vaccination were 0.4671, 0.4348, and 0.4469 (Table 6). Certainly these values are higher than expected. There some interesting findings associated with the LSM. Those that received preweaning vaccination only or neither vaccination had much higher HCW. Those values were 372.92 ± 15.59 and 378.3 ± 11.40 (Table 7) while the values for postweaning vaccination and calves that received both were much lower at 364.09 ± 1.54 and 364.52 ± 2.69, respectively. These numbers were much different than anticipated. The assumption would be that preweaning vaccination would lead to less sickness and greater weights, but the highest value for HCW observed for calves that received neither vaccination goes against all expectations.

Ribeye area (REA). Only location of the feedyard and ranch of origin had significant effect on REA ($P < 0.001$). Location of the feedyard effect may be due to slight differences in management practices and in breed type variations due to cattle being raised in different parts of the state. DOF had a P-value of

0.0535 indicating slight significance. Preweaning vaccination, postweaning vaccination, and preweaning vaccination x postweaning vaccination once again had high *P*-values. The LSM for REA of calves that received neither vaccination was slightly lower than preweaning vaccination. The calves that were not given vaccinations had a value of 88.49 ± 3.55 cm². The highest value for REA was from the calves that received both vaccinations at 90.24 ± 0.84 cm².

Table 7. Levels of significance for analysis of variance for carcass traits

	Hot carcass weight	Ribeye area	Yield grade	Gross value
Preweaning vaccination	0.4671	0.7726	0.5034	0.6176
Postweaning vaccination	0.4348	0.7346	0.5197	0.4793
Preweaning vaccination x Postweaning vaccination	0.4469	0.8721	0.7913	0.9401
Location of the feedyard	0.0587	< 0.0001	0.0032	0.9365
Preweaning vaccination x Location of the feedyard	0.5311	0.7394	0.8815	0.4645
Postweaning vaccination x Location of the feedyard	0.0525	0.7672	0.1965	0.0962
Preweaning x Postweaning vaccination x location of the feedyard	0.0594	0.4578	0.5303	0.3826
Ranch of origin	< 0.0001	< 0.0001	< 0.0001	< 0.001
Days from shipping to weaning	0.1864	0.4878	0.2559	0.4741
Days on feed	0.4823	0.0535	< 0.0001	0.0552

Yield grade (YG). DOF, ranch of origin, and location of the feedyard all showed significant effects on YG (Table 6). The *P*-values for preweaning vaccination, postweaning vaccination, and preweaning vaccination x postweaning vaccination were once again not significant. Calves that received both preweaning vaccination and postweaning vaccination had a LSM of 2.65 ± 0.08, far lower than the others. Calves that received neither had the highest, YG value, only slightly higher than preweaning vaccination, at 2.98 ± 0.32. The impact of location of the feedyard may be attributed to the different breed types of cattle that are entering the feedlot as well as slight differences in when the cattle are marketed at different locations.

Gross value (GROSS). Ranch of origin was the only variable to have significant impact on GROSS ($P < 0.0001$). DOF once again had slight significance ($P = 0.0552$). Preweaning vaccination, postweaning vaccination, and preweaning vaccination x postweaning vaccination all had no significance, and preweaning vaccination x postweaning vaccination had a *P*-value of 0.9401. The LSM showed preweaning vaccination to have the highest value at $631.66 ± 53.65 and those receiving neither vaccination was observed to be $622.66± 39.25. Postweaning vaccination was the lowest at $588.59 ± 5.26.

Chi-square tests were done to test the distribution on how vaccination protocols affected quality grades. Table 8 shows the percentage of calves that did or did not receive a preweaning vaccination and percentage distribution into each category. The percentage of those that achieved quality grades of choice and above, select, and standard and below for cattle that did not receive a preweaning vaccination was 51.66, 43.13, and 5.21, respectively. The same quality grades for cattle that did receive a preweaning vaccination were 48.34, 45.04, and 6.6 percent, respectively. McNeill (1999) and Schneider et al. (2009) both reported that cattle receiving treatment were less likely to grade choice. The percent of cattle receiving a preweaning vaccination and did not require medical treatment was 86.31 and those that did not receive a preweaning vaccination and were not treated was 81.54 percent. Based on those results and previous research expectations, it was projected that cattle receiving, a preweaning vaccination would have had the higher percentage achieving a quality grade of choice or above. The Chi-square test has a P-value of 0.60 indicating that there were no differences in the distributions of the population across those two factors.

Table 8. Distribution of preweaning vaccination and quality grade[a]

Preweaning vaccination	Choice	Dark cutter	Prime	Select	Standard	Total
No	354	10	3	298	26	691
	29.35%	0.83%	0.25%	24.71%	2.16%	57.30%
Yes	247	13	2	232	21	515
	20.48%	1.08%	0.17%	19.24%	1.74%	42.70%
Total	601	23	5	530	47	1206
	49.83%	1.91%	0.41%	43.95%	3.90%	100%

[a] Chi-square = 2.77, P = 0.60

The distribution for postweaning vaccination and quality grade (Table 9) differed from that observed in the distribution of preweaning vaccination. There are large differences in the number of observations in each catagory. Calves that received a postweaning vaccination represent 88.97% while those that did not only make up 11.03% of the population. The *P*-value was 0.8323 indicating there are no differences in the population. The percentages of cattle that received no postweaning vaccination and graded choice or above, select, and standard or below were 49.62, 43.61, and 6.76, respectively. Those that received a postweaning vaccination graded choice or above, select, and standard or below were observed to be 50.33, 43.99, and 5.69 percent, respectively. The percentage breakdown was similar for both groups. Again, expectations were that those that received a postweaning vaccination would result in improvement in quality grades compared with cattle that did not receive vaccinations.

The distribution for calves that received medicine treatment at the feedyard and quality grade follows expectations noted in Table 10. However, the data were shifted very much to one side. The number of observations for those that did not receive medicine treatment was 1017 compared to 189 for those that did. The cattle that were not treated graded choice or above, select, and standard or below were 52.80, 42.18, and 5.01 percent. The cattle that were treated graded choice or above, select, and standard or below were 36.51, 53.44, and 10.05 percent. This is consistent with expectations. Studies done by McNeill (1999) and Schneider et al. (2009) showed similar numbers for cattle that were and were not treated at the feedyard. This was the only test of quality grade distribution with a *P*-value of <0.0001 indicating that the distribution were not similar.

Table 9. Distribution of postweaning vaccination and quality grade[a]

Postweaning vaccination	Choice	Dark cutter	Prime	Select	Standard	Total
No	66	2	0	58	7	133
	5.47%	0.17%	0.00%	4.81%	0.58%	11.03%
Yes	535	21	5	472	40	1073
	44.36%	174%	0.41%	39.14%	3.32%	88.97%
Total	601	23	5	530	47	1206
	49.83%	1.91%	0.41%	43.95%	3.90%	100%

[a] Chi-square = 1.4682, P = 0.8323

Table 10. Distribution of medicine treatment at the feedyard and quality grade[a]

Treated	Choice	Dark cutter	Prime	Select	Standard	Total
No	532	21	5	429	30	1017
	44.11%	1.74%	0.41%	35.57%	2.49%	84.33%
Yes	69	2	0	101	17	189
	5.72%	0.17%	0.00%	8.37%	1.41%	15.67%
Total	601	23	5	530	47	1206
	49.83%	1.91%	0.41%	43.95%	3.90%	100%

[a] Chi-square = 29.30, P < 0.0001

Statistical Summaries of Feedyard Location

A unique aspect of the Ranch of origin to Rail program is that feedyards in different regions of the state were utilized to feed the cattle out. Table 11 shows the simple statistics for cattle fed in the North feedlot and the Table 12 shows the same data for cattle fed in the South. The ADG for the North fed cattle was 1.44 ± 0.24 kg while the South was 1.36 ± 0.24 kg. HCW was heavier for the South cattle at 371.77 ± 36.68 kg compared to 357.77 ± 31.65 kg for the North. REA for the North cattle was 85.20 ± 10.26 cm^2 and the South cattle had a REA of 94.23 ± 10.90 cm^2. Medicine cost was similar for both feedyards with the North having a cost of 4.02 ± 11.13 and the South with 4.51 ± 12.01. The South had a better yield grade at 2.66 ± 1.11 compared to 2.83 ± 0.86 for the North. The cattle in the North had a higher GROSS as well as initial value at 603.30 ± 113.53 and 484.08 ± 67.63 respectively. The same categories for the cattle fed in the South were 587.95 ± 120.02 and 438.88 ± 40.78. Cattle in the South were backgrounded longer with days from shipping to weaning at 80.32 ± 52.41 days and the North at 54.32 ± 32.83. DOF was higher in the South at 215.18 ± 35 and the North was 186.43 ± 18.52. Differences among the means at the two locations may be a result in differences in breed type.

Table 11. Simple means for traits of interest for steers fed in the north

	Number of observations	Mean	Std. dev	Minimum	Maximum
ADG[a]	599	1.44 kg	0.24	0.26	2.03
HCW[b]	588	357.77 kg	31.65	259	450.88
REA[c]	585	85.20 cm²	10.26	51.60	121.26
Medicine cost	599	$4.02	11.13	0	85.18
YG[d]	586	2.83	0.86	0.55	6.55
GROSS[e]	599	$603.30	113.53	-35.06	869.26
Initial value	599	$484.08	67.63	280.46	657.75
Days from shipping to weaning	599	54.32	32.83	0	177.00
DOF[f]	599	186.43	18.52	116.00	207.00

[a] Average Daily Gain
[b] Hot carcass weight
[c] Ribeye area
[d] Yield grade (formula calculation without adjustment)
[e] Gross value
[f] Days on feed

Table 12. Simple means for traits of interest for steers fed in the south

	Number of observations	Mean	Std. dev	Minimum	Maximum
ADG[a]	619	1.36 kg	0.24	0.32	1.95
HCW[b]	619	371.77 kg	36.68	237.68	494.87
REA[c]	611	94.23 cm²	10.90	66.44	130.29
Medicine cost	626	$4.51	12.01	0	120.50
YG[d]	615	2.66	1.11	0	8.20
GROSS[e]	626	$587.95	120.02	72.62	961.18
In value	626	$438.88	40.78	331.76	561.60
Days from shipping to weaning	626	80.32	52.41	0	197.00
DOF[f]	626	215.18	35.00	45.00	267.00

[a] Average Daily Gain
[b] Hot carcass weight
[c] Ribeye area
[d] Yield grade (formula calculation without adjustment)
[e] Gross value
[f] Days on feed

Correlation Coefficients

Pearson correlations of each trait were performed on the cattle fed in the North and in the South. The correlation coefficients for the North are listed in Table 13. ADG and HCW had a coefficient of 0.59. ADG and GROSS had a coefficient of 0.60. HCW had the highest coefficient for the group with GROSS at 0.77 and was also 0.62 for initial value. This table indicates that growth traits are most correlated with GROSS. There are some strong negative correlations for several traits as well. REA and YG have a correlation of -0.59. This relationship shows the steers that produced carcasses with larger REA received lower numerical YG, as would be expected. Another strongly negative correlation coefficient was for initial value and DOF. This indicates that calves that enter with the lower initial value require more DOF. Since initial value is going to be largely determined by weight, this number reflects that lower initial value calves will enter the feedlot at lighter weight and thus will be fed longer the reach their market endpoint. DOF also has moderate negative correlation with ADG, HCW, REA, and GROSS at -0.26, -0.42, -0.37, and -0.30, respectively. This correlation indicates that longer DOF negatively affect live performance and carcass traits. Another negative correlation to note is that of medicine costs and GROSS at -0.31. Surprisingly, these traits were not more strongly correlated as calves with higher medicine costs would also be expected to have lower performance and a reduced GROSS compared to healthy steers. There are several other traits that show moderate correlation. REA had a correlation with

Table 13. Pearson correlation coefficients and associated P-values of traits of interest for steers fed in the north

	HCW[b]	REA[c]	Medicine cost	YG[d]	GROSS[e]	Initial value	Days from shipping to weaning	DOF[f]
ADG[a]	0.59	0.27	-.023	0.16	0.60	0.08	-0.09	-0.26
	< 0.0001	< 0.0001	< 0.0001	0.0001	< 0.0001	0.0476	0.0278	< 0.0001
HCW[b]		0.35	-0.14	0.30	0.77	0.62	-0.17	-0.42
		< 0.0001	0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
REA[c]			0.002	-0.59	0.43	0.32	0.07	-0.37
			0.9711	< 0.0001	< 0.0001	< 0.0001	0.1027	< 0.0001
Medicine cost				-0.12	-0.31	-0.02	0.05	0.07
				0.0029	< 0.0001	0.6930	0.2582	0.0933
YG[d]					0.05	0.13	-0.23	0.04
					0.2722	0.0014	< 0.0001	0.3012
GROSS[e]						0.48	-0.10	-0.30
						<0.000	0.0165	< 0.0001
In value							-0.15	-0.60
							0.0002	< 0.0001
Days from shipping to weaning								0.15 0.0001

[a] Average daily gain
[b] Hot carcass weight
[c] Ribeye area
[d] Yield grade
[e] Gross value
[f] Days on feed

GROSS and initial value with values of 0.43 and 0.32, respectively. Initial value has a coefficient of 0.48 with GROSS. HCW has a coefficient of 0.35 and 0.30 with REA and YG, respectively. These moderate coefficients indicate that Initial value and GROSS, which are largely determined by weight, show a correlation with heavier calves being more muscular with heavier carcasses. The relationship of HCW and YG can be explained by a study done by Parrett et al. (1985). In the study, steers where fed different fat thickness endpoints. The results confirmed heavier carcass weights as fat thickness increased; consequently, the extra fat deposition of steers being fed to heavier weights could result in both heavier HCW and higher numerical yield grades.

Table 14 shows the correlation coefficients for cattle fed in the South. Results were similar as in the North cattle. The coefficient for ADG and HCW was the highest of all traits at 0.77. ADG was also highly correlated with GROSS at 0.62. HCW and GROSS had a value of 0.74. Once again, the traits associated with growth are highly correlated with GROSS. As observed in cattle fed in the North, REA and YG as well as initial value and DOF have strong negative correlations at -0.54 and -0.52, respectively. This further reinforces that calves with larger REA receive a lower YG and lower initial value calves require more days on feed. Moderate correlations of interest were YG with ADG and HCW at 0.38 and 0.44 respectively. GROSS and REA had a coefficient of 0.30 and the same value was seen for GROSS and Initial value. Similar values were seen in the North fed group for the correlations of HCW and YG, REA

Table 14. Pearson correlation coefficients and associated P-values of traits for steers fed in the south

	HCW[b]	REA[c]	MED[d]	YG[d]	GROSS[e]	In value	Days from shipping to weaning	DOF[f]
ADG[a]	0.77	0.13	-0.12	0.38	0.62	-0.07	0.18	0.03
	< 0.0001	0.0011	0.0067	< 0.0001	< 0.0001	0.0777	< 0.0001	0.4893
HCW[b]		0.28	-0.19	0.44	0.74	0.03	0.22	0.18
		< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.5070	< 0.0001	< 0.0001
REA[c]			-0.03	-0.54	0.30	0.12	-0.05	0.04
			0.4367	< 0.0001	< 0.0001	0.0035	0.1894	0.2699
Medicine cost				-0.13	-0.37	-0.0004	-0.4	-0.15
				0.0008	< 0.0001	.9913	0.2623	0.0002
YG[d]					.15	-0.14	0.15	0.23
					0.0002	.0007	0.0001	< 0.0001
GROSS[e]						0.30	0.15	-0.16
						< 0.0001	0.0001	< 0.0001
Initial value							-0.11	-0.52
							0.0043	< 0.0001
Days from shipping to weaning								0.08 0.04

[a] Average daily gain
[b] Hot carcass weight
[c] Ribeye area
[d] Yield grade
[e] Gross value
[f] Days on feed

and GROSS, and Initial value and GROSS. The correlations were expected due to cattle weight and muscularity potential impact on GROSS. The difference to note is ADG and YG at 0.38. This suggests that calves that gained the fastest had a higher YG. This could be due to the calves that gained faster also deposited more external fat causing a rise in their YG

SUMMARY

Calfhood respiratory vaccinations are an important consideration as part of a sound management protocol. The idea is widely accepted by the participants in this trial with 90.86 percent of the calves sent to the feedlot receiving at least one vaccination. The benefits of proper timing of the injections proved to have little effect on carcass traits. Preweaning, postweaning, nor a combination of the two vaccines had any significant effect on hot carcass weight, ribeye area, yield grade, or gross value. Preweaning vaccinations impacted initial value and medicine costs but had no effect on average daily gain. The LSM value was unexpected for initial value with it being the smallest value of the four. Preweaning vaccination was also associated with the lowest morbidity rate that was observed. Postweaning vaccination showed no significant influence on any of the traits that were analyzed. The combination of preweaning and postweaning vaccinations had similar results to preweaning vaccination alone. While some level of BRD resistance is expected no matter the timing of the vaccine, those vaccinations that are given while the calf is in the least stressful environment that it will experience as it moves through the production chain should prove most beneficial.

Ranch of origin of origin was statistically significant for all traits that were analyzed. Differences in genetics and management practices from each of the ranches of origin that participated ultimately had the greatest impact on the traits that were measured. The purpose of this study was not to examine individual ranch of origin. The involvement of numerous people in the production of cattle is one of its most unique traits. With that comes a great deal of variability, and it is clear that different production practices dictate how cattle will perform in the feedlot and the quality of the carcass that is harvested.

Like ranch of origin, days on feed is another trait worth noting. It was significantly influenced by average daily gain, medicine cost, and initial value, days on feed also significantly impacted yield grade and was slightly significant on ribeye area and gross value. Heavier calves that enter the feedyard have some advantages through the feeding phase. This may force the need for producers to evaluate some management practices as well as their genetic selections to be able to meet the demand of the stocker and feeding operations.

As evidenced in the quality grade distribution in Table 10, cattle not requiring treatment for BRD are more likely to express their genetic potential to achieve the choice grade. Effective diagnosis and treatment of BRD were critical in maintaining not only beef cattle performance but profitability. The research conducted analyzing the lung lesion scores illustrated a potentially larger problem in dealing with this issue. More research is needed to develop cost effective and labor efficient testing to help diagnose those cattle that may have subclinical infections. Education of cattle producers is also needed. There is no way to account for the stage of production that the lesions occur, but educating cattle producers to identify and treat BRD at the ranch could prove beneficial in treating cattle early and helping to curtail future problems.

With cattle being fed in the two different locations, it was interesting to look at the differences between the groups. The cattle fed at the North feedlot had a higher average daily gain, fewer days on feed, higher initial value, and higher gross value. The cattle fed in the South had heavier hot carcass weights, larger ribeye area, and lower numerical yield grades. The Pearson correlations were similar among all traits for the groups except for hot carcass weight and initial value in the cattle fed in the North. These traits were strongly correlated for this group while there was no correlation seen for the group fed in the South. Since initial value is heavily influenced by weight, it is easy to see that this correlation exists. You would expect the cattle fed in the North to have more *Bos taurus* influence with cattle in the South having more *Bos indicus* influence. Breed composition may heavily influence the difference observed between the different feedyard locations.

The results did differ from expectations with less significant impact seen by the respiratory vaccinations through the feeding phase and traits measured on the rail. There does however seem to be the greatest impact when cattle receive vaccinations while still nursing the cow. Preconditioning with early vaccinations as part of a sound management plan should provide the greatest result to the producer for calves entering the feedlot. The results are less conclusive for those producers looking at retained ownership. More work needs to be done in this area to provide producers with information for protocols that have the greatest impact on feedlot performance as well as helping to achieve carcass premiums through retained ownership.

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VITA

Name: Bobby Cleave Bingham

Address: LSU AgCenter
PO Box 158
Livingston, LA 70754

Email Address: bbingham@agcenter.lsu.edu

Education: B. S., Animal Science
Texas A&M University
August 2004