Effects of Feedlot Disease on Economics, Production and Carcass Value*

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Bovine Respiratory Disease (BRD) remains as the most serious infectious disease problem in stocker and feedyard operations. The 1991 economic impact has been estimated to be $624 million.[9] Major advances have been made in respiratory vaccines, pharmaceuticals and management systems, however, the problem remains. It seems likely that a major obstacle to reducing respiratory disease is the reluctance of many segments of the beef industry to adopt technology and practice management systems known to reduce disease incidence.

Economic Impact of Respiratory Disease

The most obvious economic losses resulting from BRD are medicine costs and death loss. In the Texas A&M Ranch to Rail Summary Reports, medical costs for calves becoming sick ranged from $20.76 to $37.90 per head for the studies reported from 1992 through 2000.[14-21] Ranch to Rail calves are fed in commercial feedlots under commercial conditions and the reported medical costs are similar to those in other feedyards. Repull or retreatment rates greatly impact the cost of medical treatment for BRD.

Economic losses due to death loss can also be significant. The basic cost of death loss for each surviving calf is calculated by multiplying the purchase cost per head by the percentage death loss. The total cost of death loss exceeds the basic cost of the calf because of processing charges, treatment costs, feed consumed and interest.

Calves sold prematurely, or railed, are another noteworthy expense. When calves are marketed early due to poor performance or a chronic disease condition, losses range from $240 to $307 per head.[14-21] When calves are placed in the feedlot in the fall of the year, it is common for the railer rate to be similar to the death loss.

Respiratory disease can have a dramatic affect on feedlot performance. Historically, the veterinary profession has done a rather poor job of linking health and performance. Fortunately, much information demonstrating the impact of respiratory disease on feedlot performance has been published during the last several years. Due to group feeding, the effect of BRD on feed efficiency is not well defined. There are, however, numerous reports that illustrate the effect of BRD on subsequent gains.

The difference in average daily gain (ADG) between those calves that remain healthy and those that have suffered BRD can be quite significant. In receiving studies ranging from 28-42 days in length, differences of 0.31-0.50 lb per day have been reported.[1,11,13,22] Calves requiring two or more courses of therapy for BRD experience even greater losses in daily gain as compared to calves requiring only one treatment. In a 28 day study conducted by Van Donkersgoed *et al*, calves never sick gained 2.75 lb per day, while those treated once for BRD gained 2.62 lb per day and those treated with two or more courses of therapy gained 1.54 lb per day.[22] In an Oklahoma receiving study, calves that did not become sick gained 2.32 lb per day during a 42 trial, while those treated once or more than once gained 2.17 and 1.83 lb per day, respectively.[13] A 90-day Canadian trial[8] showed that calves experiencing an episode of BRD gained 0.39 lb per day less than those remaining healthy, while those treated two or more times gained 0.73 lb less per day. In a 150 day feedlot finishing study, Oklahoma researchers found that steers never treated for BRD gained 0.09 and 0.4 lb more per day than steers treated once or more than once, respectively.[6] These data illustrate the very negative effect of repulls or retreats on subsequent performance.

Differences in ADG between treated and untreated cattle persist until close-out when the calves are sold. The difference in ADG tends to narrow as days-on-feed increases. In a report by Bateman *et al*[1], calves which had been treated for BRD gained 0.14 lb per day less than those not treated. In the Texas A&M Ranch to Rail feeding trials, calves never treated gained as much

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as 0.56 lb per day more than those which had been sick.

In a Nebraska report,[24] lungs were examined at slaughter for the presence or absence of pulmonary lesions. Average daily gain of calves with pulmonary lesions at slaughter was reduced by 0.17 lb per day during the 273 day feeding period. Interestingly, the Nebraska group found that 78% of calves that had been treated had pulmonary lesions at slaughter, while 68% of untreated calves were observed with lesions. Bryant *et al* reported that the presence of pulmonary lesions at slaughter was associated with decreases in ADG ranging from 0.073 to 0.65 lb per day.[4] Oklahoma State University researchers[6] reported that steers without pulmonary lesions at slaughter gained 3.48 lb per day during a 150 day feeding period. Steers with inactive pulmonary lesions gained 3.15 lb per day, while those with "active" pulmonary lesions gained only 2.57 lb per day. Each lung that had a lesion was classified as inactive or active based on the size and appearance of the local lymph nodes. Among the seers never diagnosed as sick, 37% had respiratory tract lesions at slaughter. Of steers diagnosed with BRD and treated, 48% had lung lesions. These studies suggest that current methods of detecting sick calves may be inadequate. This may also partially explain the improvement in performance following antimicrobial metaphylaxis of high risk stocker and feeder cattle.

Scientists at Texas A&M University have calculated the total cost of BRD during the feeding period. Healthy steers returned from $49.55 to $123.86 per head more than steers that became sick and required treatment. The lower value of steers that got sick was due to increased medical costs, poorer performance, reduced carcass quality grade and increased death loss and railer rate. Based on arrival weight, steers that become sick were worth from $8.65 to $20.34 per hundredweight less than steers remaining healthy.[14-21]

Using similar logic, Oklahoma scientists have estimated that from $20.00 to $35.00 per head is lost due to BRD for each stocker calf imported into Oklahoma.[7]

Relationship of Clinical BRD, Lung Lesions and Carcass Grade

The Texas A&M Ranch to Rail studies have demonstrated a consistent difference in the percentage of cattle that grade USDA Choice between those which had been "sick" during the feeding period and those remaining "healthy" (Table 1). Gardner *et al*[6] reported a slight reduction in marbling score for steers treated for BRD, resulting in a higher percentage of carcasses being graded USDA Choice and Select among steers not treated; these differences were not statistically different. In a subsequent Oklahoma study, 428 lb heifers were backgrounded for 42 days prior to feedlot entry.

Table 1. Relationship of clinical BRD to carcass quality grade.

	Percent Choice	
Year	"Sick"	"Healthy"
1992-1993	28	40
1993-1994	19	26
1994-1995	33	39
1995-1996	32	38
1996-1997	26	40
1997-1998	23	42
1998-1999	24	41
1999-2000	37	54

Texas A&M Ranch to Rail – North/South Summary Reports 1992-93 to 1999-2000.

When slaughtered at the end of the finishing period, 66% of heifers never treated for BRD graded Choice, while 59% of those treated once and 41% of those treated more than once graded USDA Choice.[12] These data suggest that catabolic events, such as BRD, can have long term effects on carcass quality. If the beef industry continues movement towards value based marketing, the effect of BRD on carcass traits significantly add to the total economic liability posed by BRD.

Managing Calves to Reduce the Impact of BRD

The information regarding economic losses due to BRD clearly illustrates that BRD is costly to the beef industry. It demonstrates that there are opportunities to improve production efficiency. If the beef industry will move forward to reduce losses due to BRD, cost of production should decrease. Improving production efficiency is one step toward becoming competitive with other meats.

The calf needs to be prepared for where it is going, not where it has been. In order to accomplish this, a complete herd health and nutritional program must be in place on the farm or ranch of origin. For example, one study has shown that calves with inadequate passive transfer of maternal antibodies are at greater risk of suffering BRD (odds ratio = 3.1) in the feedlot than are calves with adequate passive transfer.[23] This implies that selection of cows with suitable maternal traits and a nutritional program adequate for colostrum and milk production are starting points for a satisfactory calf rearing program.

Disease management or herd health programs on the farm of origin are also essential. Vaccination, nutrition and other management programs that reduce disease incidence during the pre- and post-weaning pe-

riods seem to reduce disease and production problems while the calf is in the feedyard. Calves persistently infected with the BVD virus, for example, are at greater risk of suffering fatal disease, especially after leaving the farm of origin. Such things as parasite burden, energy and protein deficiency and vitamin and trace mineral deficiencies or imbalances all tend to compromise the immune system.[10]

A vaccination program is a part of the total herd management system. Many calves in the United States are not vaccinated against BRD until they are weaned and sold. Obviously this system is not nearly as effective as one that manages time-stress-exposure relationships. Immunization takes time, often two weeks or more, and often requires multiple vaccinations. The incubation period for most respiratory diseases is only a few days; therefore, immunization should begin well before exposure.

An example of a sample management and vaccination program is shown in Figure 1. This program can be modified to meet the individual needs of the farm or ranch. By branding time or two to three months of age, calves should be dehorned and bulls castrated. Horns are a major cause of bruises in finished feedlot cattle and bruises cost the beef industry $4.03 per head marketed.[5] When calves are dehorned later in life, there is a slight reduction in gain and a slight increase in sickness, with the cost of the lost gain and increased morbidity estimated to be $5.00 per head.[3]

- At branding time (2-3 mo of age)
  - Castrate
  - Dehorn
  - Growth implant
  - Clostridial bacterin given SQ

Optional

  - IBR-PI_3 (MLV chemically altered) KBVD-MLV BRSV or intranasal IBR-PI_3 or MLV IBR-PI_3-BVD-BRSV

- Two to four weeks prior to weaning
  - IBR-PI_3 (MLV chemically altered) KBVD-MLV BRSV or
  - MLV IBR-PI_3-BVD-BRSV
  - Booster clostridial bacterin, given SQ

Optional

  - Pasteurella bacterin/toxoid if calves will be sent direct to the feedyard at weaning or if the herd experiences notable BRD in the post-weaning period

- At weaning
  - MLV IBR-PI_3-BVD-BRSV

Figure 1. Sample vaccination/management program.

Male calves arriving at the feedlot as bulls experience higher BRD rates, lower ADG and poorer feed efficiency than comparable quality steers. It has been estimated that a 550 lb bull is worth $5.73 to $6.69 per hundredweight less than a steer of similar weight.[3] I do not feel that the increased BRD rate in recently castrated feedlot calves is due to the stress of the surgery alone, but rather it partially reflects overall poorer management on the farm of origin.

Castration and dehorning done early in the life of the calf is less stressful, less invasive and is more acceptable to those with animal welfare concerns.

On many farms and ranches vaccination with respiratory vaccines at branding time is not necessary since BRD morbidity rates prior to weaning are low. If, however, BRD is a problem between branding time and weaning, intra-nasal IBR-PI_3 or a multiple antigen viral respiratory vaccine given at two to three months of age may be helpful.

Vaccination with respiratory vaccines two to four weeks prior to weaning is critical. By beginning the vaccination program while the calf is still on the cow, immunization can begin while the calf is under minimal stress and prior to exposure. Also, maternal (colostral) antibodies have declined to negligible levels by this time, allowing opportunity for an optimal immune response.

Proper selection of respiratory virus vaccines to be used in the pre-weaning period is important. In herds where the immune status of the herd is in doubt, a vaccine combination containing chemically altered modified live IBR and PI_3, modified live BRSV and killed BVD is appropriate. This combination is cleared for use in calves nursing pregnant cows. In herds where the vaccination history is known and the cows are immune to IBR and BVD, a modified-live virus combination IBR-PI_3-BVD-BRSV vaccine is appropriate. The use of a combination MLV IBR-PI_3-BVD-BRSV vaccine in calves nursing pregnant cows is extra-label. At weaning, calves should be re-vaccinated with a MLV IBR-PI_3-BVD-BRSV vaccine.

On some larger ranches, particularly those in arid regions where cattle stocking densities are low, it may not be possible to gather calves for vaccination two to four weeks prior to weaning. In this situation, a combination MLV IBR-PI_3-BVD-BRSV should be given at weaning time and repeated in about 14 days. Obviously this is less desirable than beginning the vaccination program prior to weaning because initial vaccines are administered while the calves are experiencing higher stress and exposure. The vaccination program must, however, fit realistic management schedules.

Under some conditions, the use of a Pasteurella bacterin/toxoid may be cost effective. If the incidence of BRD is significant in the immediate post-weaning pe-

riod, the use of a Pasteurella bacterin/toxoid may reduce the morbidity rate and death loss. They are also recommended if calves go direct to the feedlot without any backgrounding period.[2] When calves are backgrounded at the farm or ranch for 45 days or more following weaning, Pasteurella bacterin/toxoids generally offer no advantage to the calves when in the feedlot.

Although calves may be backgrounded and have received the prescribed respiratory vaccines at the appropriate times, anecdotal evidence suggests that a booster vaccination with MLV IBR-PI_3-BVD-BRSV at feedlot entry may be beneficial. Perhaps this is because the bovine immune system does not reach peak function until around puberty.[10]

Conclusion

Treatment of calves with Bovine Respiratory Disease is essential but is considered a salvage procedure. With sickness, potential mortality increases, medical costs are incurred, performance is decreased and there is a loss of carcass quality. BRD is a significant obstacle to optimal feedlot performance. Prevention strategies are much more cost effective than treatment programs.

Maximum control of BRD in calves begins during the calving season with management that optimizes passive transfer of colostral antibodies. Following that, proper nutrition, sound vaccination programs, stress management and proper backgrounding periods all become part of a BRD management program. Minimizing time spent in marketing channels and minimizing commingling reduce exposure to pathogens.

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