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PUTTING BVD CONTROL ON YOUR RADAR SCREEN

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THE IMPACT OF BVD ON BEEF CATTLE PRODUCTION

Bovine viral diarrhea virus (BVDV) is a major viral disease impacting beef cattle reproduction and performance. The key source of BVDV infection is the BVDV PI animal. PI animals are the result of fetal exposure to the virus prior to the development of its immune system approximately between day 18 and day 125 of gestation. Exposure to the virus prior to day 18 may result in embryonic death and apparent infertility, while exposure after day 125 is more commonly associated with abortion, stillbirths or congenital abnormalities. BVDV not only lessens reproductive performance but also produces disease in cattle including diarrhea, respiratory insult, mucosal ulcers, and death. The virus suppresses the immune system making the animal more susceptible to infection by other viruses and bacteria therefore those infected with BVDV are less likely to recover. Work to place an economic cost associated with herds infected with BVDV is limited but a US study of the breeding herd indicated a cost of $10.00 to $14.00 per cow while more dramatic results were observed in a study conducted in Great Britain where estimates of €58 ($60) per cow were made. Additional studies within the feedlot have estimated the cost per cwt of gain to be $7.60 or approximately $30 if the animal is expected to gain 400 lbs. during the feeding period. PI calves are more efficient than transiently infected animals in spreading BVDV to other animals. Current initiatives by the National Cattlemen Beef Association (NCBA), American Association of Bovine Practitioners (AABP), the Academy of Veterinary Consultants (AVC), and state livestock associations to develop effective BVDV control programs are underway. Control programs hinge on removal of the PI animal to eliminate the most important source of exposure, effective vaccination programs, and herd level biosecurity.

INFECTION TYPES

BVD may present itself as one of two distinctly different types of infection. Animals may be infected with the virus from another animal and become ill, horizontal transmission. Infections of this type are also called transient infections (TI) or acute infections. Animals that are transiently infected may show clinical signs of illness then recover or they may succumb to other infectious agents especially respiratory bacteria such as Pasteurella, Mannheimia, Mycoplasma, and Histopholis. Non pregnant transiently infected cows most frequently recover with only minimal clinical signs, while cows infected during gestation undergo a loss of reproductive efficiency or may produce the other type of infection, persistent infection (PI).

Persistent infections occur when the cow is exposed to the virus between day 18 and 125 of gestation, and since the virus is transmitted from the dam to her offspring is referred to as vertical transmission. Persistent infections result when the developing fetus is exposed to the virus prior to the time when its immune system is fully developed. When the immune system is not developed the virus is not recognized as foreign to the fetus and no attempt by the developing fetus is made to eliminate the infective virus. The developing fetus and later the calf make an ideal incubator for the virus producing large numbers of viruses and therefore becomes a reservoir that efficiently leads to the infection of other animals. When compared to transient infections persistently infected animals shed viruses at levels 1000's of times higher and are therefore very efficient at spreading the disease. PI's most frequently result from an immune competent pregnant cow being exposed during gestation (most common source of PI's, >90%), however if a female PI lives to adulthood every calf she ever has will be a PI (least likely source of PI's, <10%). A calf that is born as a PI will always be a PI and no cattle that are not PI at birth will become a PI. PI's are considered to be the major reservoir for BVD in our cowherds. When PI's are removed from a cowherd the risk of BVD is minimized, but when a PI is left within the herd vaccinations are ineffective in preventing other cattle from becoming acutely infected, and if pregnant females are present more PI's may be created. The ineffectiveness of vaccines in preventing BVD infection in the face of challenge by a PI is the result of the high number of viruses that are shed by the PI overwhelming the immune system of even the well-vaccinated animal.

WHAT HAS TO HAPPEN TO MAKE BVD CONTROL POSSIBLE OR WHAT MUST WE ASSUME IF WE ARE GOING TO TRY AND CONTROL BVD?

When implementing a BVD control program some assumptions have to be made. The first of these assumptions is that BVD is economically important to the cattle industry. Economic data is difficult to assess in the livestock industry, the industry falls victim to price fluctuations in feed and wide swings in market values resulting in a constantly moving target. As cited above the cost of BVDV infections may range from as low as $10.00 to near $60.00 per head for the cow-calf producer and over $7.00 per cwt of gain in the feeding environment. If looking strictly from an economic vantage point we would assume that we have at least $10.00 per cow to invest in BVDV control. This $10.00 would be used for any prevention program such as vaccinations, laboratory tests to monitor the herd health and additional management requirements to insure that the risk of BVDV infection is minimized. However, when the cost of BVD infections reach the top of the range it is much easier to be convinced of the need for BVD control. With the variability of market conditions and the predicted down turn in cattle prices the need to return every dollar back to the operation during lean times is equally important as during robust market conditions. Economics alone is an adequate force to drive a BVD control program. Beyond the economic concerns another component that is not directly an economic component of the need for BVD control is animal welfare. As cattle producers we all empathize with our cattle, none of us enjoy seeing an animal waste away due to a chronic illness, and now through instant media the consuming public, although often misguided, are equally concerned that animals receive proper care, and the animal sick with BVD does not present a positive industry perception.

The second assumption is that the PI animal is the primary source of BVD infection. If the PI is removed can we rely on vaccines and other biosecurity measures to avoid infecting our cowherd? The current hypothesis of BVDV researchers is that without the PI there would be no BVDV present, and if we accept this hypothesis then a test and slaughter process would eliminate BVDV infections from our cowherds.

A third assumption necessary to approach BVD control is that we can design a biosecurity program that can protect the cowherd from infection. When we design a BVD biosecurity program there are several points to include, e.g. quarantining and testing new entries, minimizing contact with other animals including the neighbors and wildlife, effective vaccinations, and monitoring and evaluating our herd for the success of the program. If we are successful at eliminating all PI's theoretically BVD vaccinations would no longer be necessary, but there are still some questions that must be answered, such as the role wildlife plays in the disease and how can we be certain that all animals are tested and any positive animals properly handled, until these questions are answered vaccines will play a vital role in BVDV control.

A fourth assumption is that we can test effectively in a timely and affordable manner for BVD and most importantly BVD PI's. Because of the low prevalence figures 1% of all cattle in the U.S. and only 4% of all herds contain PI's, large numbers of cattle are tested without identifying any PI's.

BVD PI TESTING OR LOOKING FOR THAT NEEDLE IN THE HAY STACK

To this point the detection of PI's has been on an individual basis either through the use of immunohistochemistry (IHC) or antigen capture ELISA (AC-ELISA). The first test widely accepted was the IHC on skin samples. IHC is considered the "Gold Standard" for PI detection. Frequently in diagnostics being the "Gold Standard" does not mean the best just the first. IHC does have some limitations, it will on occasion falsely classify an animal as positive, it is a time consuming process and is a subjective test with the potential for human error. The AC-ELISA has been criticized for lacking sensitivity and for misclassifying some animals as positive. The AC-ELISA is more rapid than the IHC in identifying suspect PI animals. Both tests have similar costs with prices between $3.50 and $4.00 per sample and at that price the expense for whole herd tests become discouraging if not prohibitive. So if we are to consider bringing BVD under control we must look for a method that can economically screen cattle at a moderate cost yet provide a means of efficiently detecting PI cattle.

The basic requirement of any screening test is that it always detects the presence of the disease. The better a test is at detecting disease the more sensitive it is considered to be. Being highly sensitive results in an increase in the likelihood of falsely classifying an animal as positive. Another requirement of screening tests is that they should provide answers quickly so that management decisions can be implemented.

Serological studies have been suggested that would allow the presence of an elevated blood titer on a subset of a herd population to suggest the presence of exposure to the virus.

These studies have proposed using sentinel animals, those that have never received a vaccination, or a sample of calves at weaning prior to vaccination. Either method is used to monitor the potential exposure to BVD. In theory these concepts should work but in reality studies have not supported their validity in detecting PI's.

New technology using pooled testing of blood or skin using reverse transcriptase PCR (RT-PCR) are now being used. The technique allows as many as 100 samples to be pooled together and has shown to be able to detect the presence of the virus 100% of the time. This test can be accomplished in 48 hours at a cost of $50.00 per pool and may be done on whole blood or skin samples. This process does offer a cost effective approach to screening large numbers of cattle in a rapid time. When the test is accomplished on tissue samples the tissue may be retained for further testing using IHC or AC-ELISA. However, due to the extreme sensitivity of the process it does detect the virus from acute infections and may give positive results when animals are recently vaccinated using a modified live BVD vaccine. Studies indicate that false positive pools result less than 4% of the time. The high sensitivity and low misclassification rate indicates this test may be the key to development of a BVD control program.

WHAT AND WHEN TO TEST

To enter into a BVD control program and the required diagnostic tests for the program the first animal to test should be the calf. A negative calf means the dam was negative and she would not need to be tested, essentially a two for one test. If the calf is positive the mother will require testing but with such few expected PI's in the population the need will only rarely occur. The time for testing is before breeding, to wait until after the cows have been turned out with bulls will only result in the potential of producing more PI's in the next years calf crop plus exposing the breeding herd to the virus which may result in a loss of reproductive performance.

CONCLUSION

With the availability of added technology, the better understanding of epidemiology of BVDV and implementation of good herdsmanship through biosecurity we can address bringing BVD under control and its potential eradication.

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