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DISEASES OF CONCERN IN REPRODUCTION: BVD AND TRICHOMONIASIS

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The reproductive health is of paramount importance to the beef herd. Perhaps none have the potential to create more significant losses than infectious diseases. Infectious diseases affecting reproduction can create losses all throughout the reproductive cycle by decreasing ovulation and fertilization rates as well as increasing embryonic and fetal losses (abortion).

How an infectious disease manifests itself in an animal population is the result of the interaction of three different factors: 1) the host; 2) the infectious agent; and 3) the environment. This is referred to as the "epidemiologic triad" (Figure 1). Management practices (or lack of them) will influence all three of these factors. A common mistake is to focus on only one part of the triad. For example, trying to boost the host's resistance to a disease by vaccination without paying attention to the sources of and exposure to the agent or the environment in which the host and agent coexist, will result in less than effective suppression of the effects of the disease. Attention must be paid to all three aspects of the condition in order to maintain herd health. Reproductive diseases are no different than others in this regard.

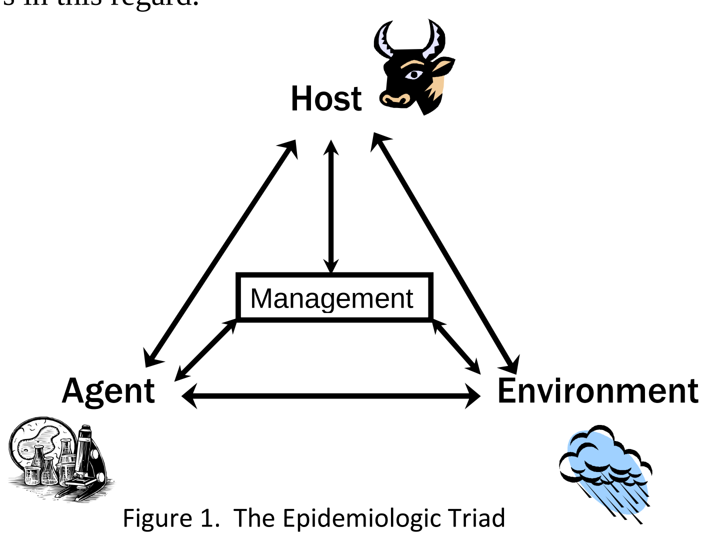

Figure 1. The Epidemiologic Triad

One management concept that affects the interaction between the host, agent, and environment is that of **biosecurity**. Simply put, biosecurity may be defined as procedures implemented to keep novel infectious agents out of a population (for example, a cow herd).

Reproductive diseases pose special challenges. Identifying specific reproductive pathogens is usually difficult. Causes of abortion, in particular, are very difficult to consistently diagnose. Roughly only a third of abortions submitted to diagnostic laboratories are diagnosed as due to a specific cause, not all of which are infectious. Infertility through decreased conception rates or early embryonic death is similarly difficult to diagnose, in part because effects of infectious reproductive disease are not always readily apparent. In most cases, a problem is not identified until pregnancy-check time, well after the inciting agent has left the reproductive tract, and sub-fertile bulls may recover enough by the time an investigatory breeding soundness examination is performed.

For all of these reasons, it is much more economical and sensible to institute biosecurity procedures in order to keep out infectious disease, rather than try to diagnose and then deal with a problem after the agents have entered the herd.

This paper and presentation will focus on two important reproductive diseases of concern here in Colorado, bovine viral diarrhea (BVD) and trichomoniasis. What follows is a brief discussion of the important aspects of these diseases. This is then put in the context of how biosecurity procedures can be implemented to keep them out of a clean existing herd or cleaning up an infected herd.

Bovine Viral Diarrhea (BVD) virus

Evidence of exposure to BVD virus is widespread throughout cattle herds in the United States and the world. The BVD virus is a pestivirus and has some unique characteristics. You will hear terms of cytopathic and noncytopathic meaning that the strain of virus can kill cells on culture or not. Other terms are Type 1 and Type 2. The important point is the virus has the capability of changing. The reproductive effects of BVD possibly surpass its other effects in economic importance, when the occurrence of persistently infected (PI) animals is factored in. Over 90% of infections involve the noncytopathic type. It is this type that is responsible for the development of PI animals. Signs of BVD in the cow herd depend on the stage of gestation in which the cow or heifer is infected. Early gestation infection results in low conception rates due to early embryonic death. Exposure of the developing fetus between about 40 and 120 days of gestation to a non-cytopathic strain of BVD result in the formation of persistently infected calves. During this timeframe, the fetus is differentiating its own cells from foreign materials. One report exists of the development of a PI calf from the use of artificial insemination of semen from a known PI bull. The result is a calf that has incorporated the virus into its own body and sheds very high amounts of virus persistently throughout its lifetime.

Later infections may result in congenital defects, late-term abortions, or the birth of congenitally infected calves, which are weaker and more prone to illness than normal calves.

BVD virus is spread through many body fluids including saliva, respiratory secretions, feces, and semen. The virus does not persist in the environment but can survive long enough to be transmitted via infected equipment, needles, and palpation sleeves.

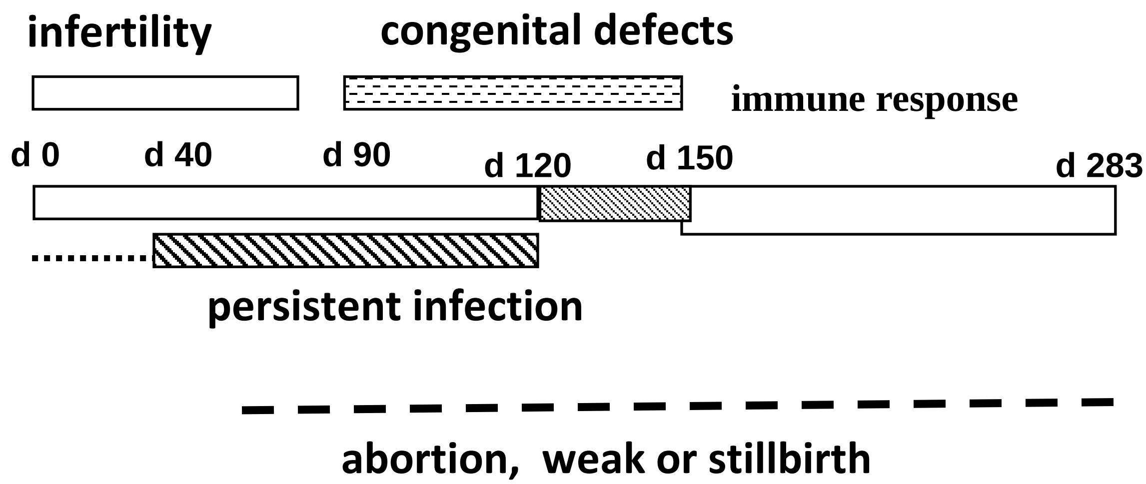

Figure 2. General fetal effects of BVD virus during gestation

Persistently infected animals shed a tremendous number of viral particles. These animals can effectively infect susceptible animals through brief (as short as one hour) nose-to-nose or fenceline contact, and can shed enough virus to overwhelm a proper vaccination protocol. When on pasture during the breeding season, they can efficiently cause the creation of more PI calves by infecting cows in the right stage of gestation.

Identification of persistently infected calves can be accomplished with various diagnostic techniques. One of the most effective is that of using an ear-notch from the calf in an ELISA test. Pooled samples using PCR testing is being used extensively for screening larger populations. This results in a yes-or-no answer and is generally extremely reliable in identifying persistently infected calves.

It is inferred in the previous discussion that biosecurity for BVD is linked with identification and removal of the PI animal. If an animal is persistently infected with BVD, no length of isolation of new additions will be long enough. A 30-60 day isolation period will, however, allow any transiently infected animals to clear their infections before contacting the existing herd. The vast majority of PI animals are produced by exposure of non PI females to the virus at the right stage of gestation to the virus. Thus, many producers chose to wait and test the offspring as a PI and eliminating PIs well before the start of the subsequent breeding season. Time needs to be allowed for all BVD exposed additions rid themselves of the virus before the breeding season. All non pregnant additions should be screened for BVD PI. Some seedstock producers are now marketing animals as "PI-test negative." As the term implies, this is not 100% proof that an animal is not PI (since no diagnostic test is 100% sensitive), but is as good an assurance as can be made.

It is usually recommended that a positive ear-notch test be re-confirmed with another diagnostic method 2-4 weeks following the initial test. This is due to the fact that transient infections may give positive results on the ear notch ELISA. This is an especially important distinction to make with valuable animals. Depending on timing and the number of calves involved, a producer may alternatively opt to dispose of all calves testing positive to the first test.

Vaccination is an important tool in the overall herd biosecurity plan, but, as previously mentioned, even a proper vaccination program can be insufficient if exposure is overwhelming. The goal of the vaccination program in the breeding herd is to prevent fetal infections. Common recommendations are for MLV vaccines used preferably 30 days pre-breeding. BVD is very commonly used in pre-conditioning programs, which usually enable vaccine given when heifers reach breeding age to be that much more safe and more effective. While in isolation, incoming animals should be vaccinated to coordinate with the existing herds' program, if possible.

Proper cleaning and disinfection of potentially contaminated equipment should be practiced, and sources of runoff between animal groups should be managed. Researchers have recently identified deer persistently infected with BVD, so the role of wildlife in the transmission of BVD warrants further study and consideration.

Trichomoniasis

Trichomoniasis is a venereal disease caused by a single-celled protozoon, *Tritrichomonas foetus*. It is ONLY transmitted sexually. Infection in the susceptible female results in pregnancy losses due to early embryonic loss, early abortions, pyometra, and rarely, late abortions. The evaluation of these losses may not always be evident at the time of pregnancy check due to the impact of length of the breeding season and when pregnancy check is relative to the end of the breeding season. If a lot of cows are in estrus at the same time, the infection rate will be decreased due to the failure to deposit enough protozoa in the vagina to infect the cow. In an Australia study comparing an infected vs non infected herd over a 4 year period of time, reported an average loss of about 19% less calvings per year and an average loss of 90 days of the infected cow before she is able to carry a pregnancy. In this study, bulls were with the cows continuously throughout the study. Only 58% of the cows were infected the first year. By end of year two all of the cows in the infected herd were infected, some for the second time. Cows being infected for the 2nd time lost an average about 30 days before they were able to maintain a pregnancy. Thus, the cow develops a degree of immunity but the loss of an average of 30 days on calf age seriously affects weaning weights and economic return. Although rare, it is also possible for a cow to carry the infection throughout pregnancy, give birth to a normal calf, and the cow be infected for up to 60 days postpartum. This suggests that aborting cows can potentially be infected for a period of time after the abortion. Typically, females are considered free of the infection in they have a period of sexual rest of 120 days.

Transmission of trichomoniasis is by sexual contact ONLY. Bulls, usually older bulls, are the asymptomatic carrier of the protozoa in the herd and transmit to cows when they breed them. The protozoan organisms are carried in the crypts (depressions) lining of the sheath and penis. infected for life. These crypts develop in bulls as they get older. Typically, bulls 3 years and older may have crypts deep enough to harbor the organisms. These crypts only deeping with age and therefore probably are capable of harboring more organisms at a time. Occasionally, we will find a younger bull that will be a permanent carrier as well. Younger bulls can also mechanically transmit the disease from an infected cow to susceptible female if the contacts occur within a very short period of time. This infers that the organism cannot survive very well on the penis and prepuce without crypts that serve as a protection. This observation has important relevance when it comes to the testing of bulls.

Having been involved in over 50 positive herds over the last 27 years I have made some distinct observations. First, it is important that all areas of the potential risks be evaluated. Just because the bull in more likely to be a permanent carrier does not mean the infected cow cannot be a source of infection. In addition, in over one-half of the infected herds that I have been involved with the infection came from the introduction of infected females. This is evident when outbreaks occur only after the purchase of open females from known or unknown infected herds who are subsequently placed with non-infected bulls for breeding. In addition, the use of semen from non-infected bulls will not result in a sustainable pregnancy unless the female has rid herself of the organism.

Many states in the west have regulations against the introduction of bulls for breeding purposes without being screened for the organism. In addition, some states require non-virgin bulls to have tested negative to three weekly culture tests before they can be sold within their states. With advent of PCR techniques some states have dropped this to a single test requirement. Although well intended it is important for producers to understand th weakness of these regulations. The real weakness of the system is sampling and period of sexual rest before sampling. Many states only require a 2 week period of sexual rest before testing. From the results presented in Table 1, this short of sexual rest period would result in missing approximately 50% of the positive bulls. Another weakness is the potential death of the organisms during travel to the diagnostic labs. Purchasing virgin bulls ensures that this disease will not enter the herd, as this is strictly a venereal disease. The introduction of non-virgin bulls or the use of leased bulls is especially risky. Non-virgin bulls should undergo the three weekly test regimen while they are in isolation if this has not been performed prior to purchase. Testing three sequential samples improves the sensitivity of the overall procedure to nearly 99.9%. Special culture pouches with transport media are necessary for a proper culture.

Table 1. Relationship of bull age and period of sexual rest on isolation of organisms in Diamonds media

Age of Bulls	Period of Sexual Rest: No Rest	20 days	28 days	90 days	>100 days
1-2	NS	0 (46)	0 (46)	0 (46)	0 (46)
3	1 (39)	2 (30)	0 (12)	4 (40)	0 (36)
4	6 (22)	1 (8)	0 (8)	3 (15)	0 (12)
5+	5 (14)	2 (7)	0 (2)	0 (7)	0 (7)

NS= Not sampled
Mortimer, unpublished 2007

Another weakness of regulations is the failure to address the impact of females in the disease. Some states do not even address the sale of females coming from infected herds. The best recommendation is for producers to plan a effective **Biosecurity** program for themselves. The false sense of security from regulated programs should not be overlooked. Some key points of the producer programs:

- Because it is only transmitted sexually it is possible that a producer or group or producers who may be at risk can address this easily by management. The goal should be to effectively eradicate the disease and prevent its reintroduction. Effectively test and sell infected bulls to slaughter.
- Introduction of new animals need to be subjected to an effective isolation plan. Females aborting should be given ample time to clear any infection before rebreeding. Segregation of late calving cows that may come from infected herds should not be placed for breeding until after about 60 days postpartum. This eliminated that potential carrier of the disease through gestation
- If you have the disease, don't try to hide it! The key is identification of the problem a putting effective managerial steps in place. Marketing of animals from an infected herd requires special considerations.
- What about vaccination? A vaccine is available for trichomoniasis, but it does not prevent infection in cows nor does it affect the status of the infected bull. The use of a vaccine does not eradicate the problem nor does it stop the economic losses associated with lost weaning weights due to a delay in conception. Its main use is for those herds already infected that are not able or willing to employ the right management tools to eliminate the disease from the herd. Certainly, the maintenance of an infected herd when you are dealing with neighbors or cooperative grazing situations is not a realistic option. Routine use in non-infected herds is not advocated.

Conclusion

Differences exist between BVD and Trichomoniasis based on methods of transmission, duration of shedding, persistence in the environment, and other factors, it is difficult to design a one-size-fits-all-diseases biosecurity program. Both of these diseases have unique challenges but both still lend themselves to some basic biosurity principles. However, the following guidelines should be considered as a base from which the producer and veterinarian can design an effective biosecurity plan. The following guidelines are based on incoming breeding stock, but it is important to remember that all incoming animals should be subjected to an isolation/biosecurity plan also.

- Be well versed with a list of questions for the seller and/or their veterinarian about the animals you are purchasing and the limitations of different screening tests and programs. Reputable producers will be straight-forward and open about the health status of their herd and animals. Some may agree to pre-purchase diagnostic testing; some may provide the name of their veterinarian so that the veterinarian of the receiving herd can communicate with them regarding herd health and proper methods of introducing the new animals. Be skeptical of herd dispersions that are not open about the health information.
- If possible, require incoming animals be screened before they get to you location. In purchasing virgin bulls require they be tested for BVD PI before purchasing. Many performance tested bulls are screened for PIs before the go on test. Test incoming animals for BVD PI with an ear-notch test. Promptly remove positive animals.
- Hold animals in isolation for 30-60 days or in the case of purchasing open females insure that you have an adequate period of sexual rest before exposing to bulls. Isolation facilities should:
    1. be sited at least as far away from the existing herd so as to not allow nose-to-nose contact between new and existing groups.
    2. not have manure runoff or drainage to or from the existing herd.
    3. be planned so that equipment and personnel do not have to be shared between sites. Alternatively, cleaning and disinfection, changes of clothes and boots should be employed, and chores done on the isolation animals after the existing herd.
- Employ appropriate vaccines, depending on the age and reproductive stage of incoming animals.
- Artificial insemination if the semen is from a reputable source. CSS guidelines for bulls studs insure that these two diseases are screened for in bulls

Because most infectious disease, including reproductive disease, enters the herd via incoming animals, a proper biosecurity plan for these new arrivals is the best defense against potentially devastating diseases and reproductive loss.

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