

## **TIMING OF VACCINATIONS IN ESTRUS SYNCHRONIZATION PROGRAMS**

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The goal of vaccination programs is to provide maximum protection to the animal during the time of greatest risk for a specific infectious disease. In ruminants, strategic vaccination against specific pathogens is also aimed at increasing the level of antibody in the colostrum, thereby improving the offspring's resistance to infection. In addition to providing infectious disease protection through vaccination, exposure to infectious agents must be minimized during high risk periods. Exposure to high levels of infectious agent can overwhelm a properly vaccinated animal. In short, vaccination alone will not prevent all infections.

Estrus synchronization programs offer an opportunity to concentrate the breeding and calving period and therefore, to focus vaccination and other infectious disease prevention efforts during periods of greatest risk of infectious disease. Although estrus synchronization can provide an opportunity for timely, concentrated vaccination of cattle; timing of administration of vaccines must also be such that reproductive functions are not disrupted. Vaccines must also be administered to cattle that are capable of mounting an adequate immune response, which requires a healthy, well nourished animal.

### **Timing of Vaccination**

The information that follows largely centers around prevention of infectious diseases that cause infertility. The impact of infectious diseases that cause reproductive loss (infertility and abortion) can be reduced through vaccination of healthy, well-nourished cows. Diseases such as bovine viral diarrhea (BVD), IBR, and leptospirosis can cause reproductive loss during early embryonic and fetal development. The use of estrus synchronization programs allow for timely administration of vaccines that will maximize herd immunity during periods of greatest risk for reproductive loss. It may be tempting to vaccinate cows at the same time injections for estrus synchronization are administered, in order to reduce the number of times cows need to be handled. However, modified-live virus (MLV) IBR and BVD vaccine may temporarily disrupt reproductive function, therefore, some precautions regarding pre-breeding vaccination are worth noting. Infection by Bovine Herpes Virus-I (the virus that causes IBR) and perhaps modified-live IBR vaccines may cause transient inflammation of the ovaries, and infection and degeneration of the developing embryo (Smith et al., 1990; Miller and Van der Matten, 1986). Infection of cows by IBR virus (or vaccination with MLV-IBR vaccines) during estrus or during early embryonic development may result in temporary infertility. It is recommended that the use of MLV IBR vaccines be avoided during the 30-day period prior to breeding and during the first three weeks after breeding.

Historically, the use of MLV IBR and BVD vaccine in pregnant cattle was widely discouraged. However, MLV IBR and BVD vaccines are now available that are labeled

for use in pregnant cows, provided label instructions are strictly followed. Immunity for BVD is long-lived (at least twelve months) following vaccination with MLV BVD vaccine (Cortese et al., 1998b). Therefore, cows may be vaccinated using MLV BVD/IBR vaccines on an annual basis and may be vaccinated during pregnancy, providing labeled instructions are strictly followed (Cortese et al., 1998b). This affords producers an option to administer MLV BVD/IBR vaccines at times that will minimize disruption of reproductive function.

### **Reducing the Impact of Bovine Viral Diarrhea Virus**

Bovine viral diarrhea (BVD) in cattle has been recognized for more than 60 years. BVD virus belongs to the pestivirus family, which includes BVD type I and type II viruses, hog cholera virus, and border disease virus. Although BVD has been recognized as a disease of cattle for decades, we are only now beginning to understand the full impact and cost of BVD. The detrimental impacts of BVD infections include decreased reproductive performance, decreased growth rate, immune suppression, unthriftiness, early culling, and increased death loss in young stock. Perhaps most important is the development of persistently infected (PI) BVD calves.

Calves may be born BVD PI when the dam and her fetus become infected with BVD virus between 18 to 125 days after conception (Grooms, 2004). During this period of fetal development, the immune system of the fetus has not yet developed and is incapable of recognizing the virus and does not develop antibody against BVD virus. Fetuses infected during this period that survive are persistently infected with the BVD virus, shedding the virus throughout their lifetime.

Individual cattle with BVD PI are the major source of infectious BVD virus in the herd (Smith and Grotelueschen, 2004). The prevalence of persistently infected BVD cattle are estimated at 0.05 to 2% of the cattle population and may be as high as 5 % (Houe, 1999). Control of BVD virus in the cattle herd is accomplished through vaccination, which is aimed at protecting the fetus from becoming PI and by identifying and eliminating the source of BVD virus (the PI calf).

#### **BVD vaccination**

Modified-live virus BVD vaccines have been shown to provide significant protection against fetal infection and development of PI calves (Kovacs et al., 2003; Cortese et al., 1998a). Inactivated BVD virus vaccines provide only partial protection in preventing fetal infection and development of PI calves (Kelling, 2004). Inappropriate (extra label) use of MLV-BVD vaccines may cause abortion and fetal defects. In addition to strategic use of vaccines, prevention programs should be aimed at identifying and eliminating PI carrier cattle in order to reduce exposure to BVD virus infection.

#### **Identifying BVD infected herds and PI BVD cattle**

Persistently infected BVD cattle are the main reservoirs of BVD virus in the herd. Identification and elimination of PI BVD cattle is critical. Ideally, PI BVD calves should be identified and removed from the herd 20 to 30 days prior to the beginning of the breeding season in order to reduce the impact of BVD on reproduction and to minimize the development of more BVD PI calves. Estrus synchronization programs help to

shorten the calving period, which will allow for testing of most calves during this time period. Reliable testing techniques to identify BVD infected cattle have become available in recent years. Several BVD testing options are available. The testing strategy used depends on whether one is attempting to determine if BVD virus is present in a herd or if one is attempting to identify individual PI BVD cattle. Following is a brief description of testing strategies used to identify BVD infected herds and individual PI BVD cattle.

### **Testing to determine if BVD virus is circulating in the herd**

*Blood samples from calves prior to feeding colostrum* can be tested to determine if BVD antibody is present. The presence of antibody indicates BVD virus is circulating in the herd and that the calf was infected in the uterus. Test six calves every 3 to 4 months.

*Blood tests on unvaccinated 6 to 8 month old heifers* or steers every 3 to 4 months will determine if BVD antibody is present. The presence of BVD antibody in these “sentinel” animals can be an inexpensive way to determine if BVD virus is (or has been) circulating in the herd and is especially useful as a monitoring tool in larger herds.

*Polymerase Chain Reaction (PCR) tests on pooled whole blood* samples can be used to identify the presence of BVD virus. It is recommended that 10 blood samples be collected from calves and shipped to the diagnostic laboratory, where they will be pooled and tested for BVD. A positive test indicates that one or more of the blood samples contains BVD virus. The individual samples can then be tested to determine which animal has BVD virus. This may a cost effective test to determine if BVD virus is present in some herds.

### **Testing to identify individual persistently infected animals**

*Immunohistochemistry test on skin samples* is a very valuable test to identify persistently infected BVD animals. This “ear notch” test has been available for a few years and has given us a simple and accurate diagnostic test that can help eradicate BVD from herds. This test is used to identify and eliminate the major source of BVD virus in the cattle herd: the persistently infected animal. As PI BVD animals are the major source of infective virus, positive animals need to be eliminated from the herd.

*Virus isolation on whole blood* to detect the presence of BVD virus in an individual animal has been the “gold standard” test for many years for identifying PI BVD animals. However, BVD virus isolation generally requires three weeks to complete and cost range is from \$15 to \$30 per sample. The accuracy of the “ear notch” test has been shown to be similar to the accuracy of the virus isolation test, is less expensive, and is user friendly.

In summary, the use of estrus synchronization programs can be used to concentrate the breeding/ calving periods in cow-calf operations. Estrus synchronization can aid producers and veterinarians in implementing timely vaccination and BVD testing programs to decrease risk of infectious disease in cattle herds. Understanding the appropriate timing of vaccinations is important to minimize the disruption of reproductive functions, especially during the pre-breeding period.

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