BVD Control for the Dairy Practitioner: Strategies and Implementation

Scott T Smith, *DVM*
The Dairy Authority, LLC, 8215 W. 20th Street Suite A, Greeley, CO 80634

Abstract

Bovine viral diarrhea virus (BVDV) continues to be an infectious disease of importance to cattle populations throughout the world. In recent years, efforts to establish BVD control programs has been a high priority for various veterinary and producer groups in North America. These efforts have resulted in the adoption of industry-wide position statements on disclosure of BVD-PI cattle. While various documents and BVD control programs have been outlined for beef cattle, few documents have been aimed specifically at BVD control in dairy cattle populations. The goal of this presentation is to focus on BVD control strategies for dairy cattle enterprises, including examples of BVD control plans from actual farms.

Résumé

La diarrhée virale des bovins (BVD) demeure une maladie infectieuse d'importance chez les populations de bovins du monde entier. Ces dernières années, la mise en oeuvre de programmes de lutte contre le BVD a été la priorité de divers groupes de vétérinaires et de producteurs de l'Amérique du Nord. Leurs efforts ont amené toute l'industrie à prendre position sur la divulgation de l'identité des bovins atteints de BVD de façon persistante. Bien qu'on ait déjà présenté divers documents et programmes de lutte au BVD pour les bovins de boucherie, peu de documents concernent de façon particulière la lutte au BVD chez les bovins laitiers. La présente communication mettra l'accent sur les stratégies de lutte contre cette maladie dans les fermes laitières, en montrant des exemples de plans de lutte provenant des fermes réelles.

Components of BVD Control Programs

In order to control BVD within a given population of cattle, it is critical that several components be taken into consideration. For the purposes of this discussion, I will divide the components of BVD control into the following categories: 1) Risk assessment; 2) Biosecurity; 3) Biocontainment; and 4) Testing (surveillance).

It is critical to address each component when assessing BVD control in a dairy herd. Depending on the population dynamics, herd history/exposure level, housing, and economic constraints, each enterprise will present a unique situation with regard to controlling BVD. No single plan will work across all management types, so a program is very much customized to each individual herd or production unit.

Risk Assessment

While there is a BVD risk assessment for beef cattle[4], I am unaware of any published BVD risk assessment tools available specifically for dairy cattle. I generally use a fairly simple, intuitive system for assessing BVD risk in dairy situations. Considerations include the population at risk, i.e. whether it is only the milking herd, calf ranch, heifer development facility, or the entire dairy production cycle. Is the herd open or closed? If open, are new additions quarantined for any period of time? If youngstock are reared off-site, are they commingled with cattle from other farms? What is the herd's history with respect to previously diagnosed cases of BVD? What is the vaccination protocol with respect to BVD–type of vaccine and timing? Is any BVD screening currently taking place, and what are the results? After going through these questions, I categorize the herd as low, moderate or high risk for BVD. Risk level can vary widely within certain populations of the same herd, so often I will assess a different risk level to the breeding heifer population vs the weaned calf and milking herd, for example. Assessing risk level gives us a starting point for discussion with the producer as to what the BVD control program may consist of for a given facility and the consequences of inadequate control for the herd down the road. I use a simple spreadsheet to outline an estimate of the costs of implementing various levels of BVD control in the herd. This "what if" scenario helps us to be realistic in both our expectations and the level of financial commitment required from the producer to see the program through. One of my biggest warnings to producers is the danger of getting into a BVD control program and then failing to complete it.

Biosecurity

For the purpose of this discussion, I will define biosecurity as the steps taken to keep an agent out of a given population. There are several procedures and practices employed by each farm as part of their bio-

security plan. Vaccination is probably the most commonly used biosecurity practice on dairies. Properly timed and administered, vaccine against BVDV works to increase resistance to infection with BVDV at both the individual and herd levels. As herd level of immunity increases, risk for transmission of BVD and creation of new PI animals decreases. However, no matter how good a vaccination program is, BVD can and does persist within cattle herds. The take-home message is that just because we vaccinate does not mean we have BVD control. Another important biosecurity practice is quarantine. Imported cattle from other herds or facilities should be quarantined for a period of approximately three weeks to ensure any transiently infected animals have stopped shedding prior to introduction to the home herd. Quarantine is very often overlooked by many producers and is a critical element for maximum impact in reducing the chance of introduction of BVD into the herd.

Biocontainment

Biocontainment refers to those actions taken to control and minimize spread of a pathogen already present in a given population. Practices implemented with respect to biocontainment are identical to those of biosecurity, with the difference being we know the pathogen is present in the herd. An example of where biocontainment and biosecurity differ with BVD would be removal of a BVD-PI animal from a population as it is identified.

Surveillance

Much of the focus of BVD control programs centers around detection of PI animals. Since the presence of PI cattle in a population is the primary means of viral infection and subsequent creation of the next generation of PI animals, it is a critical step to determine if a population of cattle is either free of PI animals or not. The three most commonly used tests for detection of PI animals are antigen-capture ELISA (ACE), immunohistochemistry (IHC), and polymerase chain reaction (PCR). Each of these detection methods has been used to successfully identify PI animals within dairy cattle populations. ACE and IHC are meant to be used as individual animal tests, while PCR allows for pooling of samples in certain circumstances. Because of these characteristics, each of these test procedures must have a place in the surveillance/testing component of a herd's BVD control plan.

Antigen-capture ELISA (ACE) detects the presence of BVDV antigen in skin, serum, or tissue. The test has both a high sensitivity and specificity, listed as 97-100% for each.[2] Typical samples tested are skin biopsies (ear notch), serum, or whole blood. Due to maternal antibody interference, calves less than four months of age should only be tested via skin biopsy. The test is meant to be done on individual samples only, and has a rapid turnaround time of less than five hours once the assay begins.

Immunohistochemistry (IHC) also detects the presence of BVDV antigen in skin biopsy samples. Immunohistochemical stain is applied to formalin-fixed skin samples, which are examined microscopically. BVD-PI animals exhibit a very characteristic staining pattern. Sensitivity and specificity are virtually identical to ACE, making the two test methods basically interchangeable.[1] A couple of minor disadvantages with IHC are the necessity to handle and ship formalin, and also that the procedure takes longer to perform by one to two days minimum.

Polymerase chain reaction (PCR) has been used on whole blood (buffy coat), serum, milk and skin biopsies. PCR allows for pooling of certain sample types, primarily serum and milk. Detection of BVD virus in milk samples is via the somatic cells present in milk. Since PCR will detect both transient as well as persistent BVD infections, follow up confirmatory testing with either ACE or IHC is typically done on individuals or contributors to positive pools to confirm PI status. Pooling of ear notch samples for PCR has been done by some laboratories for cost-saving reasons. This practice has been shown to have increased potential to result in false negative results.[3] For this reason, I do not recommend pooling of ear notch samples for dairy cattle under any circumstances. It is critical to detect PI animals accurately, and we have two tests that do an exceptional job when performed on individual animals.

One final mechanism of surveillance is the use of sentinel animals. Unvaccinated calves, typically six to 12 months of age, are housed with the cow herd and monitored for seroconversion to BVD type 1 and type II. When seroconversion occurs, the group of cattle suspected of containing the PI animal can be screened with one of the detection methods to identify BVD-PI.

Considerations for Implementation of BVD Control Programs

No two dairy operations are the same when it comes to BVD control plans. Perceived level of risk/infection, biosecurity, economic consideration, and goals of the producer are all factors to consider when setting up a BVD control program for a herd. Some producers will pursue an aggressive program which screens all animals currently on the ground for BVD-PI in a short period of time. Others will choose to commit to a less aggressive program that will take much longer to ascertain the BVD status of the herd. Still others will choose to do minimal

detection and will attempt BVD control with biosecurity measures only. These producers will obviously not be exactly sure what the herd status is, even if the risk assessment places them in the low-risk category. Our job as veterinarians is to provide as much guidance as we can when it comes to BVD control with our clients, no matter what level of control the producer wishes to obtain.

Strategies for Detecting and Eliminating BVD-PI Cattle

The ultimate goal of any BVD control program is to prevent new PI animals by preventing *in utero* infection of the 40-120 day old fetus. Since the source of infection is most often another PI animal, our goal is to detect and remove all PI cattle from the population. PI prevalence in cattle can range from 0.1% to 2%, with even higher prevalence rates in some unusual circumstances.

Youngstock

PI cattle have a higher than average death rate, so the absolute highest prevalence of PI will be in calves at birth. For this reason, many BVD control programs begin with individual testing of the youngstock at or soon after birth. An additional benefit to screening calves is that for each negative calf tested, we get a "two for the price of one" result, since a BVD-PI dam cannot give birth to a negative calf. Therefore, if we have a negative calf, the dam must also be negative. Testing at or just after birth also has economic advantages to offer. First, since we know we will be removing the calf from the herd, the younger the animal the lower the absolute loss, due to ongoing feed and production costs. In addition, removal of PI calves should have a very positive effect on overall health and performance of the calf population as a whole. Since BVD is an immunosuppressive disease, circulating BVD virus is often a precursor to other infectious agents, such as salmonellosis, that can cause significant disease resulting in production and financial losses. In most instances, once a producer decides to screen the youngstock, I recommend to individually test each heifer from birth through springers and immediately remove PI-positive animals. Alternatively, you can test each calf from birth to pre-breeding and test springers prior to returning to the milking herd. This will take a bit longer to screen the entire replacement herd, as it will take approximately one year to complete. After this, I would recommend continued screening of newborn heifer calves for at least another 12 months.

Milking Herd

Screening of the milking herd for PI cows is also an important aspect of BVD control on the dairy. In-herd prevalence rates in adults will almost always approach the 0.1% range, so individual testing of entire herds can be costly, especially as herd size increases. Fortunately, bulk-milk PCR has been shown to be an effective screening tool for groups of lactating cows up to 600 head. I recommend to always check with the lab you will be using for recommendations for maximum number of cows per sample and stick with it. Many herds that exceed the cutoff number for the lab will choose to screen pens of cows. These pen sizes may range from 50 to 400 cows per sample. No matter what sample size you use, it is important to know exactly which cows contributed to the sample so that you can accurately collect follow-up samples from the correct cows if a pool is found positive. I like to make a hard copy of the computer records listing each cow by pen for the day the sample is taken. This group of cows can then be individually tested via ACE or IHC to find the PI animal. Since

CONTROL WITHOUT COMPLICATION.™

She's just one of many that look to you to make good decisions. In a business that gets more complex every day, there's a vaccine that can simplify life for you, your clients and their herds. A highly effective choice that's safe to use anytime to protect against reproductive and respiratory diseases. A combination that has demonstrated fetal protection against IBR abortion 8 months post-vaccination.[1,2] **Vira Shield® 6. It's the vaccine that can make life a little easier for everyone.**

VIRA SHIELD™

Vira Shield® 6

- HIGHLY EFFECTIVE
- LONG-LASTING
- UNCOMPLICATED

1. Zimmerman, AD et al. Efficacy of bovine herpesvirus-1 inactivated vaccine against abortion and stillbirth in pregnant heifers. *J Am Vet Med Assoc* 2007;231(9):1386-1389.
2. Data on file at APHIS' Center for Veterinary Biologics.

www.livestock.novartis.com
(800) 843-3386

NOVARTIS
ANIMAL HEALTH

bulk-milk PCR can take up to two weeks to complete, I also recommend to take an ear notch sample from each cow that dies or is sold while the results are pending. If a pool comes up positive and one of the animals sold or died comes up on the list, then that sample can be run to make sure she was not the PI that made the group sample positive. A follow-up bulk-milk PCR should be run 90 days after the original test date to sample cows that were dry or may have inadvertently been missed on the original test. Alternatively, for smaller herds, all dry cows could be tested via ear notch while the current milking string is being tested via the milk. A follow-up milk PCR should still be run in 90 days in these cases.

Sample BVD Control Plans

Example 1- *4500-head dairy heifer feedlot*

This particular enterprise operates with the goal of being a BVD-PI free facility. Calves arrive from several dairy farms and calf ranches from multiple states at five months of age. The facility has a requirement that each arriving heifer needs to have proof of individual test-negative status for BVD-PI prior to arrival or is ear notched on arrival and ACE test is performed. In addition, each calf is required to receive two doses of modified-live viurs (MLV) BVD vaccine at least three weeks prior to arrival. Then calves are given a dose of MLV within 24 hours of arrival and a second four weeks later. On arrival, heifers are placed in a row of receiving pens at the far north end of the facility, and kept there for four weeks prior to moving to pens farther into the feedlot. These cattle are separated from the next-closest calves in the feedlot by a feed alley of about 20 feet. Breeding and pregnant heifers are separated from the arrival pens by two rows of corrals and two feed alleys to further reduce the chance of any circulating virus coming into contact with pregnant animals. All heifers receive a dose of MVL vaccine with a fetal protection label claim at approximately 40 days' gestation. In four years of operation, there has been only one calf found born PI-positive from a heifer reared at this facility. This case was traced back to an instance where one of the owners had run pooled PCR on ear notch samples. Although the offending heifer was not located, we suspect there was a PI heifer that cycled through the facility from a PCR pool that was a false negative.

Example 2- *2800 milking cows*

Initial bulk-milk screening in 2005 revealed one milking string positive for BVD by PCR. A total of 160 head of cows were tested individually using ACE testing, and a single cow was found positive. At this time, ear notch testing via ACE was initiated for all heifer calves born alive. Springing heifers were also ear notched on arrival at the dairy from a custom heifer grower. Newly purchased springing heifers were also ear notched and tested with ACE on arrival. All breeding bulls were tested via ear-notch ACE. Then, 90 days after the original screening, bulk milk samples were submitted for follow-up PCR and all samples were found negative. A third set of bulk milk samples were collected in mid-2006 and tested by PCR, and all samples were negative. Twice in 2006, lactating cows were purchased from outside herds with unknown BVD status. In each instance, bulk-milk PCR was run to screen for PI. While awaiting the results of PCR, these cows were housed in a pen in the far corner of the facility with the closest contact to other cows being across a feed alley about 30 feet wide. Both groups were test-negative for BVD using PCR. Since heifer calves left the home facility and were reared at another location where they were comingled with cattle of unknown status, ongoing testing of all female calves has continued to the present time. Occasional PI-positive calves have been born to first-lactation heifers. There have been no PI-positive calves born to mature cows in the herd since 2006. The dairy has recently (December 2008) closed the herd by completing heifer facilities at the home dairy. The plan is to screen the milking herd again and depending on results, re-evaluate the surveillance portion of the BVD control plan in the future. The biosecurity plan continues with no changes. All heifers are vaccinated with four doses of MLV BVD in the first eight months. In addition, heifers receive two doses of MLV containing BVD four weeks apart just prior to breeding. This vaccine has a fetal protection claim. Milking cows receive a dose of MLV containing BVD at three weeks postpartum and an additional dose at 180 days' gestation.

Conclusion

BVD control is an important aspect of the overall health management plan for the dairy facilities we work with. A well-developed BVD control plan takes into consideration risk assessment, biosecurity, biocontainment, and surveillance to put together a program that efficiently and effectively gets us on the way to clearing the herd of BVD PI cattle. Dairy production cycles and facilities give us many different strategies to implement programs that result in successful control of BVD.

References

1. Brodersen BW: Immunohistochemistry used as a screening method for persistent bovine viral diarrhea virus infection. *Vet Clin North Am Food Anim Pract* 20:85-93, 2004.
2. IDEXX Laboratories, Westbrook, Maine, technical bulletin.
3. Ridpath JR, Hessman BE, Neill JD, Fulton RW: Parameters of ear notch samples for BVDV testing: stability, size requirements and viral load. *Proc Am Assoc Bov Pract Conf* 39:269-270, 2006.
4. www.bvdinfo.org, Cow-calf BVD Risk Analysis Model.