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## *Bovine Viral Diarrhea Virus Control and Eradication*

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Bovine Viral Diarrhea Virus (BVDV) is estimated to cost an average dairy between $20 and $160 per adult cow per year. Large scale herd outbreaks such as occurred in the early 1990s are much more devastating and resulted in estimated losses as high as $1000 per adult cow. These losses include medication and labor to treat acute infections, milk production losses in lactating cows, infertility due to decreased conception and early embryonic death, abortions, loss of weak, abnormal, or persistently infected calves. The wide variation is due to differences in husbandry practices and vaccine use.

### *Disease Manifestations*

BVDV infection can be divided into two separate categories, acute infections and persistent infections. **Acute infections** occur when a susceptible animal is exposed to another animal that is shedding virus. Most acute infections cause minor disease and may go completely unnoticed. Clinical signs include fever, lethargy, decreased appetite, and decreased milk production. Many adult dairy cows may show these signs during lactation and some of these are transient acute BVDV infections. Most acute BVDV infections respond with minimal or no treatment and are not definitively diagnosed. Occasionally, acute BVDV can cause severe systemic signs resulting in diarrhea and/or bleeding disorders with a high fatality rate. Such outbreaks occurred in dairies with insufficient vaccination programs during the early 1990s. BVDV is related to respiratory disease because it tends to suppress the immune system of infected cattle and potentiates the other viral and bacterial respiratory pathogens.

**Persistent infections** develop in the fetus of a pregnant animal that is infected with BVDV between 50 to 150 days of gestation. During this time of gestation, the fetus is developing its immune system and becomes tolerant to the virus. The virus itself causes minimal tissue damage and the fetus and future calf is able to live with the virus without mounting an immune response to eliminate the infection. **Persistently infected animals are the major source of virus in a dairy and readily expose and infect all other in contact animals**. Many persistently infected animals appear normal at birth. Others may appear stunted or weak at birth. Nearly 80% of persistently infected calves die of unspecified disease before they reach one year of age. Between 0.5% and 5% of calves born on a dairy where BVDV is present are persistently infected.

Fetal infection during gestation does not always result in a persistent infection. Early fetal infection can result in embryonic death and pregnancy loss. Herds with endemic BVDV may observe a 5% to 10% reduction in reproductive efficiency. Infection any time during gestation can result in abortion. In some herds, BVDV accounts for 30% or more of spontaneous abortions. Infections between 80 and 180 days of gestation can result in a variety of congenital abnormalities. The most common and easily identified abnormalities observed include small or absent eyes (microophthalmia) and abnormal brain development (hydrocephalus, hydranencephaly, and cerebellar hypoplasia). Calves with brain abnormalities often have domed heads or may display neurological signs including the inability to stand, tremors, or even seizures.

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# *Maintaining the Flow*

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This article will address the quandry about data flow described in a previous article (Western Dairy News, May 2002): What is being and should be done to ensure assess to data that will benefit the total dairy community.

An example that affirms the need for data flow and access is the DairyMetrics application developed by DRMS (Dairy Records Management Systems). DairyMetrics is an Internet based benchmarking application. A user signs on to the DRMS website (http://www.drms.org/) and selects DairyMetrics. This application allows the user to benchmark his herd against the other 13,000 herds maintained in the DRMS database. To improve the comparison a large number of location and production characteristics can be selected to create a cohort of herds that are similar in nature. If a producer has a herd of 150 Jerseys, milked 3 times daily (3x), and located in Texas, all other Jersey 3X herds in Texas that had between 1 and 200 cows could be selected. This allows comparison against a group of herds that are "comparable" in size, breed, location, and number of times milked. To ensure confidentiality of the data, at least 5 herds must qualify for the selection process.

Although DairyMetrics provides access to herds processed at DRMS, what about herds that process through other processing centers? The Standard Transfer Format (STF) was developed by the processing centers as a way to move individual cow records from one center to another in order to ensure that base line data is not lost from cows when they are transferred between centers. These data contain the base test day values, but they do not provide for transfer of the non-test day values such as health events nor does a provision exists for transferring herd averages. If DairyMetrics provided for inclusion of no-DRMS herds into a database, the value of this evaluation technique would be enhanced greatly.

What about other databases? Most other centers limit data to their center's processed data. The closest thing we have to a national database is that maintained by the Animal Improvement Program Laboratory (AIPL) at USDA. This data is the basis of the genetic evaluations that have successfully served the dairy industry. Other reproduction and fertility data could easily be sent to AIPL. With this added data, the potential exists to develop reproduction and fertility values for sire and cow evaluations. If AIPL had this database, how would others gain access to it for making management decisions? Procedures need to be developed that allow access to this database as in the DairyMetrics example. If AIPL is hesitant to develop the access protocols, possibly a processing center or other third party vendor might embrace the task.

We should not be limited to collecting "historic" data. Information as simple as parlor and housing type would significantly enhance the value of using a database for problem solving capabilities. Other parameters, such as milk tank and wash water temperature, that identify dairy values are becoming as important in a dairy process control function as are milk weights. With the advent of programs to monitor the milking process, no standards exist to integrate this data with production data. Feed inventory programs are providing a mechanism to input and track feed inventories, yet allocation of costs to cows is not integrated. Some producers that own multiple operations are hiring "professionals" to develop integrated packages in order to access data they deem necessary to profitably manage their operation.

How can our industry improve the flow and accessibility of data in order to improve management and profitability? We need to reach consensus on the requirements that are essential to the integrated on farm management consortium. Such requirements are data definition and variable calculations. Just as AIPL imparts a degree of "authenticity" to a bull proof, should not there be a similar set of standards in the on-farm data collection business? National DHIA has made efforts to standardize data collection processed through the Quality Certification program. However, the administration of this program rests with the Council on Dairy Cattle Breeding, which only represents three components of the industry; herd recording, purebred associations and artificial insemination companies. The Milking Machine Manufactures Association generally does not become involved in herd management records because it focuses on the collection of events at cow side. Veterinarians and nutritionists access data and incorporate it into databases and spreadsheets for use by their clients. It seems no standard "PTO" connection exists for the herd information industry.

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***(BVDV, continued from page 1)***

### *Vaccination Benefits And Limitations*

While BVDV vaccines have been available for many years, we are still no closer to eliminating BVDV and the diseases associated with it than we were 20 years ago because vaccination alone is not sufficient to eliminate BVDV from an infected dairy herd. Current modified live and killed BVDV vaccines are generally effective at preventing the majority of overt clinical disease associated with acute infections. However, these vaccines do not fully protect against fetal infection. Recently, some vaccines have demonstrated the ability to protect the fetus from infection and are marketed with this claim. It must be emphasized that this protection is not complete and ranges between 50% to 80% protection in controlled studies. Modified live BVDV vaccines tend to perform better than killed vaccines in this regard.

### *Diagnostic Testing and Eradication Strategies*

Comparison of the estimated costs of BVDV ($20 to $160 per adult per year) and current testing and eradication strategies (estimated $5 to $10 per adult including labor, supplies, and testing) suggest that BVDV eradication programs are economically justified in dairies. The development of a simple, inexpensive test that utilizes a sample that can be easily and conveniently obtained by dairy personnel has made this possible. As always, you should consult with your herd veterinarian in developing and implementing any disease control and eradication program.

Confirming the presence of BVDV in a herd is the first step in developing a BVDV control and eradication program. Suspicion is based on the observation of typical clinical signs including animals with non-specific fevers, decreased fertility, increased abortions (>3% per year), calves with birth defects, and small, stillborn, or weak calves. Periodic serological screening of unvaccinated calves greater than 4 months of age is an effective method of confirming the presence of BVDV. Blood samples from 5 calves in a group of weaned calves should be submitted for both type 1 and type 2 BVDV serology ($5 per sample). Titers greater than 1:512 are consistent with recent infection in the calves and suggest the presence of a persistently infected calf in the commingled group. Similar testing can be performed on adult cattle however it is more difficult to interpret due to vaccine-induced titers.

If the presence of BVDV is confirmed, a BVDV eradication program should be investigated based on economic considerations. Eradication of BVDV is economically advantageous if the cost of testing, eradication, continued surveillance and control is less than the cost of the disease. **The focus of eradication strategies is to identify and eliminate persistently infected animals and thus remove the source of BVDV in a herd.**

The gold standard diagnostic test is virus isolation on blood samples. Unfortunately this test requires the ability to collect blood samples and is relatively expensive ($20 per sample). Standard virus isolation is best used to confirm acute infection in an animal and will also detect persistent infections. Many other tests have been developed to identify persistently infected cattle including the microtiter ELISA, antigen capture ELISA, skin immunohistochemistry (ear notch test), and PCR assays. Each of these tests have specific advantages and disadvantages but are generally limited by practical application and cost. The microtiter ELISA and antigen capture ELISA tests ($5 per sample) use blood samples and accurately detect persistent infection in animals greater than 6 months of age. However, false negative tests can be observed in younger animals due to interference from maternal antibody obtained from colostrum. Skin immunohistochemistry ($21 per slide, up to 6 samples per slide) is a good test for screening young calves and will work in the presence of maternal antibody. A major advantage of this test is that calving personnel can collect ear notch samples from calves at birth with minimal training. The drawback is that samples must be processed within 2 weeks of collection to get accurate results. Thus, multiple samples must be collected and sent within several days to benefit from the economic advantages of this test.

Recently, the Antigen Capture ELISA skin (ACEsk) test was described for the detection of persistently infected animals. This test has the advantages of simple sample collection (ear notch), prolonged stability with storage, standard laboratory assay, no inhibition by maternal antibody, high level of accuracy, and low cost ($3 to $5 per sample). For this test, ear notch skin samples are collected and placed in a small plastic tube with sterile saline. The sample is stored in the refrigerator or freezer for up to 6 months. Samples are sent to the diagnostic laboratory and the standard antigen capture ELISA test is performed on the saline solution. Results can be obtained within 48 hours of receiving the samples. The cost of this test is reduced for multiple samples.

Two general strategies may be employed to identify persistently infected cattle and eliminate BVDV from a herd. The

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first strategy employs the testing of all cattle on the premises at one time. For this protocol, blood or ear notch samples are obtained from all animals over 6 months of age and submitted for either antigen capture ELISA or ACEsk, respectively. Ear notch samples are obtained from animals less than 6 months of age for the ACEsk test. All cattle including any bulls must be tested. This strategy may be feasible in small dairies but is often logistically and economically impractical in larger dairies.

An alternative strategy is to test all calves at birth using the ACEsk test. This protocol is logistically feasible in any size dairy and spreads the cost of the program out over the entire calving interval. Skin samples may be submitted to the laboratory in groups at standard intervals. It is recommended that calves with a positive test be re-tested prior to culling. The dam of any positive calf must also be tested by either a blood test or skin test as she may be persistently infected as well. The dams of all negative calves can be considered negative themselves and do not need to be tested in the future. All bulls or other cattle on the premises that are not expected to have calves must also be tested individually by either a blood test or skin test. Aborted fetuses and their dams should be tested. It must be stressed that calves should not be commingled or housed within 20 feet of breeding age cattle until the calves are confirmed negative. This testing strategy must be continued until all animals have been directly tested or they have had a calf that tested negative. All persistently infected animals should be euthanized or sold directly for slaughter.

### *Continued Biosecurity*

Once BVDV is eradicated from a herd, precautions must be established so that the herd is not reinfected. A comprehensive vaccination program should be maintained, as potential reintroduction of BVDV into an immunologically naive herd could be devastating. The most likely way of introducing BVDV into a herd is the purchase of a persistently infected animal or a negative animal already carrying a persistently infected fetus due to exposure at the herd of origin. Springing heifers from heifer rearing facilities are particularly at risk of carrying a persistently infected fetus. Thus, all new introductions into a herd, including their offspring and any bulls must be tested as described above. Since the standard tests used to pick up persistently infected animals do not always detect acute infections, incoming animals must be quarantined for 3 weeks prior to introduction into the common herd and exposure of pregnant animals.

With the advent of improved diagnostic tests, interest in BVDV control and eradication has developed on a regional and naton-wide basis. However, until the time of complete eradication, vigilance will be necessary to sustain a BVDV-free herd.

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The reason integration has lagged is that new players are continually being added to the team. DHI is no longer the only dairy records program. Consultants and veterinarians are playing greater roles in championing software programs on herd management. The impact of the land grant system composed of University and cooperative extension specialists, at one time a stabilizing force for the industry, has diminished. Where will consensus come from? Many leaders have advocated that a trade association is needed to bring consensus and establish guidelines and procedures industry-wide. However, without producer commitment to develop standard industry-wide herd management software the systems will never be integrated.

The dairy industry needs to develop a set of protocols that will allow all data that is written to a standard to easily flow into all software programs. Only with this integration will programs be developed that are interchangeable and used within the system. But will integration lead to loss of a competitive advantage? The simple answer is no. Software in and of itself will not make you money. It is how you use it that will increase profitability. Producers need to demand that all dairy software is integrated in order to increase management powers.

Dairies continue to consolidate and herds become more complex to manage. As stricter requirements for identification and other health related issues increase, the need is there to have the necessary programs to meet these developments. By establishing a set of standard protocols and allowing third party developers to access our database, new and innovative programs can be developed through which producers can increase profitability.

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