BVD Overview
The Disease, Management & Control
MICHIGAN STATE UNIVERSITY

THE PIONEER LAND GRANT COLLEGE
Objectives

- Continue industry education about BVDV
- Continue industry dialog about BVDV control
- Implementation of cost effective control programs
- Significant reduction (if not elimination) of BVDV related losses
- My specific objective - to provide background
What is BVD

- Viral infection of cattle
  - Bovine viral diarrhea virus (BVDV)
  - Sheep, pigs, camelids, cervidae, etc
- RNA virus
  - Can rapidly mutate and change
- Diverse clinical presentation
  - Not just “diarrhea”
- Diverse antigenic make-up
  - Creates challenges with vaccines and diagnostics
Phylogenetic tree of official and putative (●) Pestivirus species. Adapted from Bauermann et al. and used with permission from J. Ridpath.
BVDV

Thrombocytopenia

Acute Death

Immunosuppression

Acute Diarrhea

Subclinical Infection

Transient/Acute/Primary Infection

Mucosal Disease

Normal

Poor Performance

Immunosuppression

Fetal Infection

Normal

Abortions

Congenital Infections

Early Embryonic Death

Congenital Defects

Persistent Infection
Transient Infection
BVDV

Mucosal Disease

Congenital Defects

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Abortions

Congenital Infections

Early Embryonic Death

Persistent Infection
Persistent Infection With BVDV

- Occurs following fetal infection prior to ~day 125 of gestation
  - Acute infection of dam or;
  - Persistently infected dam
- Virus recognized as “self” antigen
- Results in calf being born that is immunotolerant to BVDV which leads to persistent infection with BVDV
Persistent Infection
Following Transient Infection of Dam
Persistent Infection Following Transient Infection of Dam
Persistent Infection
Born To PI
Persistent Infection
Born To PI
Characteristics of PI’s

- Lifetime carrier and shedder of BVDV
- Virus usually present at high titers in:
  - Blood
  - Excretions and secretions
    - Nasal secretions
    - Saliva
    - Feces/Urine
    - Semen
    - Milk
  - Tissues including skin
- May be normal, but more typically are poor performers and survivability is low
Why Control BVDV?

- Increased productivity
- Increased economic return
- Decreased health risk
- Increased animal welfare
- Industry momentum
- International movement to eradicate BVDV
BVD Economics
Effects of Persistent Infection

- 10 year farm profitability model
  - Reduced pregnancy rate (5%)
  - Increased preweaning mortality (10%)
  - Decreased weaning weight (0.5%)
- Economic effect was $14.85-$24.84 per year
decreased return to fixed costs per beef cow exposed

Larson et. al., Bov Pract 2002;36(2):106-112
BVD Economics
Effects of Persistent Infection

- Feedlot study in high risk cattle
- Cost of exposure to PI’s
  - $41.84-$93.52 per animal exposed

Hessman et al, AJVR 2009;70:73-85
BVDV and Productivity

- Cow Calf herds containing PI’s
  - Pregnancy rates decreased by 5%

BVDV and Health

- High Risk calves in feedlot under controlled BVDV exposure
  - 11.5% morbidity in non-PI exposed calves
  - 23.5% morbidity in PI exposed calves

Important to Point Out: Not All Studies Show That BVDV Has Impact

- Variability in virus virulence
- Variability in types of cattle
- Variability in management

➢ Demonstrates we still have much to learn about BVDV
Industry Momentum: BVD Position Statement

“.........beef and dairy industries adopt measures to control and target eventual eradication of BVD virus from North America.”

Academy of Veterinary Consultants, 2001
Endorsed by AABP Board of Directors, 2002
NCBA Animal Health & Well-being Committee, 2003
MCA/MSU Bull Test

A cooperative effort between the Michigan Cattlemen's Association, Michigan State University Department of Animal Science and Plank Farm

Click here to download the BVD Ear Notch Test

Location:
Plank Farms
325 Mount Hope Rd.
Crystal, MI 48818
989-235-6253
email: psf@cmsinter.net

Health requirements and procedures:
The health requirements and procedures exceed regulatory requirements of the State of Michigan. These requirements have been established by the Bull Test Committee and are mandatory for all bulls prior to arrival at the bull test station.

1. Bulls must be dehorned and weaned for at least 21 days.
2. Each bull must have an initial vaccination; in addition, a booster (3 to 4 weeks later) for the diseases listed under section 6. The last shots must be given no less than 7 days nor more than 50 days before delivery to the station.
3. All bulls must be free of ringworm and warts.
4. **All bulls must test negative for Bovine Virus Diarrhea Virus (BVDV)**
5. All bulls are required to have a negative TB test within 60 days of delivery, except for bulls originating in TB accredited free herds.
6. Bulls originating from Michigan herds are not required to have a Brucellosis test.
ATTENTION - VERY IMPORTANT!!

BOVINE VIRUS DIARRHEA - persistent infections

The National Western Stock Show, as a responsible leader of the livestock industry, beginning with the 2008 show, will be requiring that all beef cattle, bison, yak and camelids shown and sold during its event show proof of a negative PI test for BVD. The National Western is in support of the AAABR-NCBA Cattle Health and Well being Committee and the Academy of Veterinary Consultant’s position stating responsible disposition of BVD persistently infected animals is an important component of BVD control.

BVD is a disease that is damaging to the industry. Cattle owners have a moral and ethical obligation to the beef industry not to sell known diseased or damaged animals without full disclosure.

Background:

* Persistently infected (PI) cattle are the major source for BVD infection and disease in cattle that come in contact with them. PI cattle become infected before they are born (about 45 - 125 days of gestation) and shed huge amounts of BVD virus throughout their lives.

* The common ways BVD is introduced into herds are through herd additions that are PI or contact with other PI cattle - including PI calves, yearlings, bulls, females and fetuses carried by pregnant females.

* Any calf, replacement heifer, bull or cow can become temporarily infected with BVD virus for a few days to weeks until their immune system can clear the virus. The disease is usually not fatal by itself, but BVD virus suppresses the immune system and makes infected cattle more susceptible to diseases such as pneumonia, scour, foot rot and others. The virus may also cause infertility and/or abortion in susceptible cows, heifers and bulls.

* Testing for PI cattle is different than testing for many other animal diseases in that PI status stays the same throughout the animal's life. In other words, a non-PI animal will be negative its entire life and a PI animal will remain so its entire life. Because of this fact, PI testing is usually done once. A test for PI status only needs to be repeated to confirm a positive, or if evidence indicates, a faulty test. As with all tests, a few false-positive and false-negative results can occur.
New Zealand

Europe

International Eradication Efforts
Demonstration Project
- Education
- Industry engagement
- Control Program
  - Testing for PI’s
  - Biosecurity
  - Vaccination

Programmed Approach To BVDV Control

Bad planning is buying a new saddle for an old horse!
BVDV Control

- Understand Goals, Objectives and Risk Tolerance
- Develop prevention/control plan using:
  - Biosecurity
    - Reduce risk of BVDV entering operation
  - Identify and Eliminate PI’s
    - Eliminate major source of transmission
  - Improve Herd Immunity
    - Immunization
Goals and Objectives of a BVDV Control Program

- Goals and objectives will help to direct what the ultimate plan will look like
- Example:
  - Diagnostic Testing
    - Goal: Selling replacement heifers -vs- cleaning up a BVDV infected herd
  - Biosecurity Plan
    - Goal: commercial cow-calf herd -vs- pure bred seed stock operation
Risk Tolerance

- Need to determine how much BVDV risk you are willing to undertake
  - Examples:
    - Zero risk
      - Closed herd with internal growth only
    - High risk
      - Purchase replacements heifers from unknown BVDV backgrounds
BVDV Control Toolbox
BVDV Control

- Understand Goals and Risk Tolerance
- Develop prevention/control plan using:
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  - Identify and Eliminate PI’s
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Sources of BVDV Exposure

- PI’s or Transient Infections
  - Replacements
  - Bulls
  - Embryo’s Recips
  - Exhibition
  - Fence line
  - Shared pastures
  - Semen

- Other Species
  - Sheep/goats
  - Camelids - Llamas
  - Cervidae - Deere

- Inanimate Fomites
  - People
  - Equipment
  - Vehicles
PI Heifer Purchased as a Replacement
BVDV Control

- Understand Goals and Risk Tolerance
- Develop prevention/control plan using:
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    - Reduce risk of BVD \( V \) entering operation
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MOST WANTED

Known carrier of a virulent virus...Persistently infected with BVDV

CONSIDERED ARMED AND EXTREMELY DANGEROUS

IF YOU HAVE ANY INFORMATION CONCERNING THIS CRITTER, PLEASE CONTACT YOUR VETERINARIAN

REWARD
Detection of PI’s

Tests To Detect PI’s

- Virus Isolation (IPMA)
  - Blood
- ELISA
  - Blood
  - Milk
  - Skin
- PCR
  - Blood
  - Milk
  - Skin
- IHC
  - Skin

Individual or Pooled
BVDV Control

- Understand Goals and Risk Tolerance
- Develop prevention/control plan using:
  - Biosecurity
    - Reduce risk of BVD V entering operation
  - Identify and Eliminate PI’s
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  - Improve Herd Immunity
    - Immunization
BVDV Vaccines

- Over 150 different BVDV vaccine combinations available
  - Adaptable to different needs
- Modified live and killed vaccines
- Vaccines containing multiple viruses
  - Broader protection against antigenic variation
- Vaccines that can be used at various management times
  - Pre-breeding, during pregnancy, suckling calves, etc
Effect of bovine viral diarrhea virus vaccination on fetal infection (meta-analysis)

Do vaccines reduce risk of fetal infection with BVDV?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Risk Ratio</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>Overall</td>
<td>0.152</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MLV Vaccine</td>
<td>0.117</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Inactivated</td>
<td>0.236</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heterologous Challenge</td>
<td>0.542</td>
<td>0.055</td>
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<tr>
<td>Homologous Challenge</td>
<td>0.158</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Polyvalent Vaccine</td>
<td>0.097</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Monovalent Vaccine</td>
<td>0.177</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

0=Risk eliminated, <1=Risk reduced, 1=Risk the same, >1=Risk is greater

Vaccination is an Effective TOOL

.....NOT a Silver Bullet
BVDV Control
Summary

- BVDV is an important virus of cattle worldwide
- Losses in all sectors of the cattle industry
  - Dairy
  - Beef – Cow-calf and Fed Cattle
- Effective tools to control BVDV
  - Biosecurity
  - Diagnostics
  - Vaccinations
Integrated BVD Control Plans for Beef Operations

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Abstract

Infection of cattle with bovine viral diarrhea virus (BVDV) can result in a wide assortment of disease manifestations. Diseases related to BVDV cause economic losses to cattle producers throughout the world due to decreased performance, loss of milk production, reproductive wastage, and increased risk of morbidity and mortality. There are three broad types of BVDV infection: acute, fetal, and persistent. It is persistent infection that is predominantly responsible for perpetuating the virus in cattle populations, and animals persistently infected with BVDV are an important target for control of transmission. The approach to BVD control must be multidimensional, with consideration for all tools at our disposal including strategic management of the production system, diagnostic investigation, and vaccination. Decisions regarding BVDV control should factor into consideration the strategy's potential to decrease risk for transmission and its cost. Producers must first know with reasonable certainty if the virus is circulating in the herd. If the virus is present in the herd, then the appropriate actions are those that minimize the harmful effects of infection or work to eliminate the virus. If the virus is not present in the herd, then the appropriate actions are those that keep the herd free of BVDV and minimize losses should the virus be introduced. Recently, a new website was created to consolidate BVDV information in a single location on the internet: www.bvdinfo.org.

Keywords: bovine viral diarrhea virus, BVDV, disease control, biosecurity, persistent infection, PI

Résumé

L'infection des bovins avec le virus de la diarrhée virale bovine (BVDV) peut se manifester par plusieurs types de maladies. Les maladies associées au BVDV causent des pertes économiques aux producteurs bovins partout dans le monde, car l'infection entraîne une baisse de la performance, des pertes au niveau de la production laitière et de la reproduction et un accroissement de la morbidité et de la mortalité. Il existe trois grandes types d'infection au BVDV : aiguë, fœtale et persistante. L'infection persistante, qui est associée à l'infection persistante, est responsable d'un grand nombre de la propagation du virus dans les populations bovines et les animaux immunodéprimés au BVDV sont donc une cible importante dans le contrôle de la transmission. Le contrôle du BVDV doit comporter plusieurs facettes et prendre en compte tous les outils disponibles incluant la gestion stratégique des systèmes de production, l'évaluation diagnostique et la vaccination. Les décisions sur le contrôle du BVDV devraient considérer le potentiel de la stratégie à réduire le risque de transmission et son coût. Les producteurs doivent être capables de déterminer avec certitude s'il y a ou non le virus dans le pré. Si le virus est présent dans l'élevage, alors les actions appropriées sont celles qui minimisent les conséquences de l'infection ou qui travaillent à l'élimination du virus. Si le virus n'est pas présent dans l'élevage, alors les actions appropriées sont celles qui maintiennent le pré libre de BVDV et minimisent les pertes si le virus est introduit. Récemment, un nouveau site Web a été créé pour rassembler l'information sur le BVDV dans un seul site Web accessible à travers Internet: www.bvdinfo.org.

Introduction

More than 60 years ago an enteric disease of cattle was described in North America that was characterized by outbreaks of diarrhea and erosive lesions of the digestive tract. The disease was called bovine viral diarrhea, or BVD, and the virus causing BVD was named bovine viral diarrhea virus (BVDV). Diseases in cattle resulting from infection with BVDV cause economic losses throughout the world, stemming from decreased performance, loss of milk production, reproductive wastage,
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Top 10 Ways You Know You Have BVDV
Top 10 Reasons You Know You Have BVDV

10 When your carcass compost pile doubles as a sled riding hill for the kids!!
Top 10 Reasons You Know You Have BVDV

10  When your carcass compost pile doubles as a sled riding hill for the kids!!
9  When every animal is walking around with a strange looking V-shaped notch in their ear.
Top 10 Reasons You Know You Have BVDV

10 When your carcass compost pile doubles as a sled riding hill for the kids!!

9 When every animal is walking around with strange looking v-shaped notch in their ear.

8 When your drug rep say “It can’t be BVDV, you used our vaccine”.

Top 10 Reasons You Know You Have BVDV

10. When your carcass compost pile doubles as a sled riding hill for the kids!!
9. When every animal is walking around with strange looking v-shaped notch in their ear.
8. When your drug rep say “It can’t be BVDV, you used my vaccine”.
7. When your calf barn could double as a Halloween House of Horrors!!
Top 10 Reasons You Know You Have BVDV

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8. When your drug rep say “It can’t be BVDV, you used my vaccine”.
7. When your calf barn could double as a Halloween house of horrors!!
6. When you think BVD stands for “Bad Veterinarian Disease”

Dr. Grooms DVM
Top 10 Reasons You Know You Have BVDV

5 When your thoughts about your breeding program and the presidential election are one and the same!!
Top 10 Reasons You Know You Have BVDV

5. When your thoughts about your breeding program and the presidential election are one and the same!!

4. When your nutritionist blames poor health on your previous nutritionist who blamed it on his/her predecessor who blamed it on............
Top 10 Reasons You Know You Have BVDV

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3. When you have cattle on your farm named “Runt”, “Pipsqueak”, “Shorty”, “Wobbles”, “Tiny”, “Clutzo” and “Nubby”.

Will I ever grow up!!
Top 10 Reasons You Know You Have BVDV

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2 When you’ve just won a million dollar law suit against the electric company because of “stray voltage”, but herd health still stinks.
Top 10 Reasons You Know You Have BVDV

5. When your thoughts about your breeding program and Washington DC are one and the same!!

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1. You’ve lost everything but your
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