What Can We Learn From International BVD Experience?
Dr Christoph Egli, IDEXX
Top Three Dairy Cow Disease Issues?

- Lameness
- BVDV
- Mastitis
How to Manage Disease Status?

- Identify sick animals: feed intake, fever, milk drop
- Monitor performance parameters
- Establish a program: Control, Eradication
  - Discretionary
    ‣ Own initiative
    ‣ Private
    ‣ Economic value driven
  - Governmental
    ‣ Industry protection-improvement
    ‣ Welfare
    ‣ Consumer Health/Protection
      ‣ Traceability from stable to table
      ‣ Food safety
Control and Eradication

- The terms "control" and "eradication" are used in literature to refer to different degrees of disease reduction. Useful definitions of these terms were formulated by Andrews and Langmuir in 1963:
  - "Control is the purposeful reduction of specific disease prevalence to relatively low level of occurrence, though transmission occurs frequently enough to prevent its permanent disappearance.
  - Eradication is the purposeful reduction of specific disease prevalence to the point of continued absence of transmission within a specified area."
Control and Eradication Programs

- **BVDV**
  - most impactful and most costly disease worldwide!
  - Control programs in USA, China, Australia, New Zealand
  - Europe: eradication helps!
    - Bavaria, Germany:
      - 30 mio € more profit for Bavarian cattle farmers \(^{(1)}\)
    - Ireland:
      - Annual losses in the Irish cattle industry estimated €102 mio.
      - The *total* cost of a 6 year eradication program estimated €54 mio.
      - Benefit: cost ratio for eradication was estimated to be 10:1
      - A *return of €10 for each € spent* during the six years of the program
        (see also [http://animalhealthireland.ie/page.php?id=22](http://animalhealthireland.ie/page.php?id=22))

\(^{(1)}\) Wittkowski BVD DAY Nantes, France 2013
Acute (Transient Infection)

- Acute (transient infection)
  - Mild disease, very widespread
    - Causes Immunosuppression
      - Respiratory infections worse with BVD
        - Other viruses IBR, BRSV, and Bacteria (M. haemolytica)
      - Enteric infections worse with BVDV
        - Other viruses and bacteria (Salmonella)
    - Poor fertility
    - Milk drop
  - Virus quickly cleared in 10-14 days
  - Antibody response for long time (bulk milk sample)
Persistent Infection

- Persistently infected (PI) calf is born infected but tolerant to BVDV
- Remains infected and contagious for life (“super-shedders”)
- Do not produce antibodies (usually)
- Up to 1% or more in a national population
  - RVC study*: 0.3-3% (highest in non-vaccinating herds)
    *Booth and Brownlie 2012
- Most die of mucosal disease within 18–24 months
- Others appear healthy, live to adulthood, continually infect others

*Source: BVD Virus Control & Eradication Recommendations for Cow-Calf Production; Academy of Veterinarian Consultants.
### BVD Effects on Pregnancy

- **Persistant Infection**
  - Early embryonic death
  - Foetal death, abortion and Mummification

- **Congenital defects**

- **Sero-positive calf**

#### Months of gestation

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
Increased Mastitis & SCC: Is BVDV Hurting These Herds?

- Season bulk-milk somatic cell count (SCC) averages by herd exposure to BVDV³
  - Measured by IDEXX BVDV Total Ab Test
  - 870 herds tested
- BVDV-exposed herds had **26% higher** bulk-milk SCCs than BVDV-free herds
Increased Number of Abortions

- Increased abortion rate results in:
  - Loss of potential replacement heifers
  - Early culling of productive cows
  - Reduced production caused by extended calving intervals

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### BVDV and Abortion: Impact on a typical Dairy

<table>
<thead>
<tr>
<th>Impact</th>
<th>Cost or Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of dairy abortions caused by BVDV</td>
<td>2-7%</td>
</tr>
<tr>
<td>Cost of increased days open caused by early abortion</td>
<td>$2 to $5 per day</td>
</tr>
<tr>
<td>Loss when days open increases to 45 as a result of early abortion</td>
<td>$90 - $225</td>
</tr>
<tr>
<td>Loss if 20% of a 200 cow herd abort</td>
<td>Up to $4500</td>
</tr>
<tr>
<td>Loss of potential replacement heifers following late-term abortions</td>
<td>$1000 - $1500 per cow</td>
</tr>
<tr>
<td>Salvage loss from early culling of productive cows</td>
<td>$500 - $700 per cow</td>
</tr>
<tr>
<td>Drop in herd's potential calf production due to increasing calving interval from 12 to 13 months</td>
<td>2-5%</td>
</tr>
<tr>
<td>Loss in average producing dairy herd due to calving intervals over 14 months</td>
<td>&gt;10%</td>
</tr>
</tbody>
</table>
The Bull

- PI bull
  - May have poor fertility
  - Always a source of infection (virus shedders)
- New infection in un-infected bull
  - Effects on fertility
  - Disease may be severe
- Always Test Them!
- Test import and export semen/embryos
Cost of Disease in UK*

- IBR £6 mio/year (range £5.2-7 mio)
- Johne’s £0.8 mio/year (range £0.3-10 mio)
- Leptospirosis £11 mio/year (range £5.2-24.6 mio)
- BVD £39.6 mio/year (range £25.4 – 61.1 mio)
  - Losses associated with reproductive disorder
  - Losses from outbreaks of BVDV simultaneously with other infections
  - Individual cow level: estimated costs are £37 per cow per year (Gunn et al., 2004)

*An Economic Assessment of Livestock Diseases in Great Britain Bennett & Jpelaar (2003), University of Reading
## The Economic Impact of BVDV

<table>
<thead>
<tr>
<th>Article</th>
<th>Country</th>
<th>Cattle Type</th>
<th>Reported Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi et al. Prev Vet med</td>
<td>Canada</td>
<td>Dairy</td>
<td>$31.07 per cow</td>
</tr>
<tr>
<td>Duffel et al. The Veterinary Record</td>
<td>UK</td>
<td>Dairy</td>
<td>$31.10 to $88.75 per cow</td>
</tr>
<tr>
<td>Gunn et al. The Veterinary Journal</td>
<td>Scotland</td>
<td>Beef cow-calf</td>
<td>$72.68 per cow per year</td>
</tr>
<tr>
<td>Hessman BVD Control Conference</td>
<td>U.S.</td>
<td>Beef feedlot</td>
<td>$41.17 per head</td>
</tr>
<tr>
<td>Houe Vet Microbial</td>
<td>Denmark</td>
<td>Dairy</td>
<td>$20.00 to $57.00 per calving</td>
</tr>
<tr>
<td>Larson et al. Bovine Practitioner</td>
<td>U.S.</td>
<td>Beef cow-calf</td>
<td>$15.33 to $20.16 per cow</td>
</tr>
<tr>
<td>Moenning et al. Animal Health Res, Reviews</td>
<td>UK, Norway, and Denmark</td>
<td>All breeds</td>
<td>$10.00 to $40.00 per calving</td>
</tr>
<tr>
<td>Ridpath Hoard’s Dairyman</td>
<td>U.S.</td>
<td>Dairy</td>
<td>$35.00 to $65.00 per calving</td>
</tr>
<tr>
<td>Wentink et al. Tijdschr Diergeneeskd</td>
<td>Netherlands</td>
<td>Dairy</td>
<td>$81.71 per cow</td>
</tr>
</tbody>
</table>
Ages of Animals Identified in BVDV-Infected Herds

Note that 28% were 2 years or older (Booth and Brownlie 2012)
Testing Is Critical

• Persistent infection makes BVDV extremely difficult to eliminate from a herd
• PI animals are the main source of BVDV transmission and shed 1000 times more virus than a transiently infected animal
• Testing is the only way to identify a PI animal
  - Early testing is critical so that PI animals can be removed before they spread infection
  - Removing PI animals is the best way to reduce overall production loss and impact of medical costs on a herd
  - BVDV-tested calves may bring added value to a herd
IDEXX Test Solutions

• BVDV Ag Test for use with blood or ear notches
  - Most used ELISA test in current programmes world wide
  - Find PI animals

• RealPCR BVDV RNA Test (coming soon)
  - Whole blood, serum, ear notch samples
  - Find PI animals

• BVDV Ag Point-of-Care Test
  - For use on farm, results within 30 minutes

• BVDV Ab Test for use with blood or tank milk
  - Total antibody test, p80 antibody test
  - Identify and survey BVD
Advantages of Becoming a BVD Free Farm

- Healthier cattle, less expense for treatments
- Production gains and clear cost benefit
- Welfare advantage
- Potential trade advantage
BVDV Disease Management Tools

- Diagnose disease: IDENTIFY viral shedders (PI animals)
- Apply biosecurity:
  - ISOLATE and REMOVE PI animals
  - Avoid disease transfer from one farm to another
  - Test incoming cattle before adding to pen/herd
  - Attention: buying pregnant animals (could carry PI)
  - Avoid farm to farm contacts
  - Monitor herds using antibody tests
- Vaccinate
  - Primary course before 1st service
  - Booster vaccination
  - Use as directed
BVD Programs Overview

• Acknowledgement of BVD as a notifiable disease in eight European countries:
  - Austria, Belgium, Denmark, Finland, Ireland, Germany, Norway, Sweden and Switzerland.
• Recent decision by the OIE to list BVD as a priority disease in terms of animal trade is a strong signal.\(^8\)
• US cattle producers recently responded to the problems associated with BVDV infections by drafting a policy document with the ultimate aim to eradicate BVD from America.\(^8\)
• New Zealand scientific community has moved BVD higher up on the industry’s list of priorities.\(^8\)
• Regional BVDV control and eradication programs ongoing in various countries.
BVDV Control Strategies

• Vaccination
  - limited to no reduction of BVDV in cattle populations – success only on herd level
• BVDV antibody surveillance
  - Use with serum or tank milk
  - Survey and monitor success of PI elimination
  - Assess/determine herd status
  - Monitor vaccination
• BVDV Ag and RT-PCR testing:
  - Test newborns, dead calves, trade animals and introductions (ear notch or blood), test the dams of PIs
BVDV Control Programs

- Control programs (regional, private initiatives, large scale testing, but also testing in remote areas)
  - Bulk milk testing to find antibodies or virus
  - Identify virus positive animals
  - Avoid spread of virus
  - Countries:
    - USA, China, Australia, New Zealand, Brazil, Costa Rica, etc.
  - Export markets
BVDV Eradication Strategies

• Since ~50 years: vaccination
  - limited to no reduction of BVDV in cattle populations – success only on herd

• Since 1993: „Scandinavian model“
  - finding virus-shedders using antibody screening (blood, milk), if positive:
  - PI search (via Ab testing or directly)
  - Cheap way to classify herds
  - Cave: missing PIs
  - Can take many years
  - successful, but long term perspective (~20 and more years)

• Find and eliminate PI-animals
  - 1999: first BVDV Ag Erns catching ELISA commercially available from IDEXX
  - Quick and very successful strategy
  - Expensive at beginning but pays off due to short duration of program
  - Test all newborns, dead calves and introductions (ear notch or blood)
  - Eliminate PIs, test the dams of PIs
  - Effective and straightforward
  - Program only takes a few years
BVDV Eradication Programs

• Eradication (nationwide efforts with governmental support, large scale testing)
  - Ongoing with successful progress (eliminate PIs)
    ‣ Austria
    ‣ South Tyrol (Italy)
    ‣ Switzerland
    ‣ Germany
    ‣ Scotland
    ‣ Ireland
  - Programs planned in:
    ‣ France
    ‣ Belgium
The Scottish Government BVD Eradication Program

- “Prevent the production and circulation of PI animals”
- Phase One
  - September 2010 – March 2011
  - Support for screening tests of breeding herds
  - Publicity and Communication
  - EUR 470,000 to subsidize farm screenings
  - EUR 125 / farm
  - 3,550 farms participated
  - 3,063 Beef  77% positive
  - 487 Dairy   52% positive
The Scottish Government BVD Eradication Program

- Phase Two
  - December 2011 onwards
  - Compulsory
  - All breeding cattle herds must have Annual Screening for BVDV

- Possible screening methods:
  - Sample 5 unvaccinated calves 9-18 months old
  - Single Bulk Milk test with individual Blood Tests
  - Four Quarterly Bulk Milk tests
  - Test all calves (where vaccination is in place)

- (Based on CHeCS Technical Document)
The Scottish Government BVD Eradication Program

• Phase Three
  - December 2012 onwards
  - Compulsory
    - If herd cannot demonstrate freedom from BVDV:
      - Unable to move cattle to other holdings unless each individual tested
      - Illegal to knowingly move a PI animal to another holding
      - Infected herds must provide biosecurity to neighboring farms
    - Extend scheme to Non Breeding Herds
Welsh Schemes...

- Launched January 2011
  - EUR 46,500 subsidized cost of BVDV Testing
- 100 farms – “first come first served”
- EUR 4.7 per sample up to 100 samples
- Technical advice from Royal Veterinary College for those taking part
England: Numerous Schemes

- England: Numerous Schemes
- Often in the hands of private practices
- Some regional schemes some of which have received funding from government via regional development funds
- Presently, no central coordination or even database
- Most follow CHeCS principals but not regulation
Ear Notch Collection in BVDV Eradication Programs

- Ear notch collection tube
- Ear tags
- Ear notch samples sent to lab
- Plier to apply ear tags
- Herd list

Test With Confidence™
BVDV Eradication Program Switzerland

- Phase 1 (2008): test all (ear notch) – eliminate PIs!
- Phase 2 (2009-2011): test newborn calves (ear notch) – eliminate PIs!
- Phase 3: survey presence of BVDV Ab in herds
- PI prevalence dropped from 0.64% at start to less than 0.05% (December 31, 2012)
- 2013: antibody surveillance in milk and serum
- Lessons learned so far:
  - Program must be easy and understandable
  - Everybody involved must be informed
  - Mistakes can happen: sample mix-up, trade of untested calves
BVDV Eradication Program Switzerland - Facts

• Whole cattle population tested at start (>1.3 mio head + 600K calves per year)

• False data in cattle database (national animal record) at start
  - Farmers must correct and update data

• Ear tags – sampling failure rates

• Cost estimate:
  - about 60 Mio CHF for whole program

• Distribution of costs:
  - 1/3 Farmers – 4 CHF/animal for 3 years
  - 2/3 Counties – eradication funds

• Ear notch sampling (main method):
  - Positive result confirmed by PCR in blood

• Incentive for a PI-animal (must be slaughtered):
  - 300 CHF
BVDV Eradication Program Germany

• December 2009:
  - Legislation official to start controlling and eradicating BVDV as per January 1, 2011
  - Ear notch testing
  - Newborns and trade animals: about 4.8 Mio animals tested per year
  - Decisions per state (n=16) on diagnostic tools and ear tagging systems (mostly tenders)
  - Testing done in state labs
  - Financials: paid by funds (per state)

• Official start was 1st January 2011:
  - Goals:
    ‣ Reduction of PI prevalence
    ‣ Establish virus free animals and farms (certified)
  - Results 2011*:
    ‣ More than 6 mio animals tested in 2011
    ‣ Major sample type: ear notches
    ‣ 80% of testing done with IDEXX BVDV Ag Serum Plus Test in 31 official labs
    ‣ 0.36% of all born calves (n=4.836 mio) were detected as PI and removed

* Schirmeier, FLI, 2nd EAVLD 2012, Kaziemierz, Poland
BVDV Eradication Program Germany

• 2012:
  - More than 40'000 PI animals identified since start of program (1st January 2012)
  - Decrease of cumulative PI prevalence from 0.5% in 2011 to 0.24% in 2012

• 2013:
  - Continuous decrease of PI prevalence in some states (Bavaria, Baden-Württemberg)
  - Reduced success in other states.

• 2014:
  - More than 44'000 PI animals identified since start of program in 2011
  - Cumulative PI prevalence decreased from 0.5% in 2011 to 0.24% (2012), and 0.14 % (2013)
  - In 2’318 of total 163’000 German cattle herds a PI animal was born in 2013 (a decrease of over 60% since 2011)
  - In the first quarter of 2014, 0.07% of newborn calves were diagnosed as PIs. (April 14, 2014 – database may not yet be completed at this time)

Number of PI Calves & Cumulative Prevalence 2011-2014
# Cost Regulation by German State (I)

<table>
<thead>
<tr>
<th></th>
<th>Baden-Württemberg</th>
<th>Bavaria</th>
<th>Berlin</th>
<th>Brandenburg</th>
<th>Bremen</th>
<th>Hamburg</th>
<th>Hessen</th>
<th>Meck'burg-V'pommern</th>
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</thead>
<tbody>
<tr>
<td><strong>Sample collection costs:</strong></td>
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<td>Blood sampling</td>
<td>Prod</td>
<td>ADF</td>
<td>Prod</td>
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<td>Prod</td>
<td>Prod</td>
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<tr>
<td>Ear Notch Tag</td>
<td>Prod</td>
<td></td>
<td>Prod</td>
<td>ADF add costs</td>
<td>ADF</td>
<td>ADF</td>
<td>ADF</td>
<td>Prod</td>
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<tr>
<td><strong>Lab Diagnostics</strong></td>
<td>State</td>
<td>ADF: €3/test</td>
<td>Prod</td>
<td>State</td>
<td>ADF</td>
<td>State</td>
<td>ADF/State</td>
<td>State 50%/ADF 50%</td>
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<tr>
<td></td>
<td></td>
<td>75-300€ per PI; 50% of value for MD animal</td>
<td>no subsidies</td>
<td>100€/animal (ADF)</td>
<td>150€/animal</td>
<td>pending</td>
<td>90-300€ by age</td>
<td>no subsidies</td>
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<td><strong>Subsidy for cull animals</strong></td>
<td>ADF</td>
<td></td>
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<td><strong>Vaccination:</strong></td>
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<td>Vaccine costs</td>
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<td>pending</td>
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## Cost Regulation by German State (II)

<table>
<thead>
<tr>
<th>Sample collection costs:</th>
<th>Lower Saxony</th>
<th>North Rhine Westfalia</th>
<th>Rheinland-Pfalz</th>
<th>Saarland</th>
<th>Saxony</th>
<th>Sachsen-Anhalt</th>
<th>Schleswig-Holstein</th>
<th>Thuringia</th>
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<tr>
<td>Blood sampling</td>
<td>Prod</td>
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<td>Prod+ ADF: 1€</td>
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<tr>
<td>Ear Notch Tag</td>
<td>ADF</td>
<td>State/ADF</td>
<td>ADF</td>
<td>ADF</td>
<td>Prod</td>
<td>Prod</td>
<td>Prod</td>
<td>Prod (add cost of ear notch)</td>
</tr>
<tr>
<td>Lab Diagnostics</td>
<td>ADF</td>
<td>State/ADF</td>
<td>ADF</td>
<td>ADF</td>
<td>State</td>
<td>ADF</td>
<td>Prod</td>
<td>State</td>
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<tr>
<td>Subsidy for cull animals</td>
<td>150€/animal</td>
<td>no subsidies</td>
<td>50€/calf</td>
<td>70-200€</td>
<td>50% of value</td>
<td>Prod</td>
<td>75-150€ by age</td>
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<td>Vaccination:</td>
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<td>100€/animal</td>
<td>(ADF)</td>
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<td>Vaccine costs</td>
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<td>max 2€/animal</td>
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</tr>
</tbody>
</table>

Prod = Producer  
ADF = Animal Disease Fund  

Deutsches Tierärzteblatt 6/2011
BVDV Eradication Program Ireland

• First ever industry-led program in the dairy and livestock sector
• 2012: voluntary phase of the national BVD eradication program
• 1st January 2013 compulsory phase:
  - with legislation to test all calves born after that date for BVD.
  - approx. 1.9 million calves have been tested.
  - 98.05% negative, 0.77% positive, 0.03% inconclusive and 1.12% empty on initial sampling (as of 16th September 2013)

• Results are in line with Animal Health Ireland’s expectations of the prevalence of the disease in Ireland.
BVDV Eradication Program Ireland

- Sample volume peak of over 120,000 per week in February and March 2013.
- Financial incentives for the second and subsequent PI animal culled from beef herds announced.
- Each herd will conduct three years of tissue tag testing, followed by a further three years of lower level monitoring or surveillance.
- Two of the key criteria that must be met for a herd to move into the monitoring phase will be as follows:
  - The BVD test status of all animals in the herd must be known
  - No positive or inconclusive result to a BVD test may in the herd in the 12 months preceding the transition to the monitoring phase.
Economic Benefit

- Animal Health Ireland (AHI) launched a stakeholder consultation to gather the views of all aspects of the industry on the level of support for a coordinated industry-led national program to eradicate BVD in Ireland.

- Strong support for the programme, with a preference for the testing of tissue tag samples (taken as part of the official identity tagging process) as the primary diagnostic method.

- Cost – benefit analysis:
  - AHI commissioned SAC (Scottish Agricultural College)
  - Major findings:
    - Annual losses due to BVD in the Irish cattle industry estimated to be €102 mio.
    - The total cost of a 6 year eradication program estimated to be €54 mio.
    - Benefit : cost ratio for eradication was estimated to be 10:1
    - A return of €10 for each € spent during the six years of the program (see also http://animalhealthireland.ie/page.php?id=22)
RETENTION OF CALVES PERSISTENTLY INFECTED WITH BVD VIRUS (PIs)

Current figures indicate that approximately two thirds of PI calves identified in 2013 are now dead. However, approximately 4,300 PI animals have been retained in around 2,900 herds across all counties.

If you are retaining a PI animal on your farm:

What does that mean for you?
- The majority of PI animals do not thrive and will die before reaching 18 months of age
- Increased health problems in other stock which means increased veterinary bills and reduced performance
- Spread of BVD virus from PI animals to susceptible pregnant stock will result in more PI calves born on your farm in 2014
- This may result in you having to tissue tag test your newborn stock for more than the anticipated three years.

What does it mean for your neighbour?
- Boundary contact may result in your neighbour having PI calves born in 2014.

What does it mean for the wider farming community?
- Extension of the BVD Eradication Programme resulting in increased costs for all farmers.

The cross-industry BVD Implementation Group continues to recommend that all PI cattle are culled as soon as possible after being identified.

For 2014 the goal is to have no PI animals retained at the start of the breeding season to avoid creation of further PI calves.
The Benefits of a BVD Control/Eradication Program

- Get rid of one of the world’s most costly bovine infectious diseases.
- Improve herd health and cattle production
  - better fertility
  - healthier calves
  - less treatments
  - less costs for medication
  - increased milk production
  - better prices for trade animals
- Favorable cost-benefit ratio expected if between-herd spread can be controlled
  (Biosecurity - strong determinant for BVDV control)
What Can We Learn From International BVD Experience?

• Programs are successful if
  - All stakeholders are informed and committed, and are continuously communicating
  - Program is easy to understand and execute
  - Economic benefit calculated and shown (investments returning to local industry)
  - Incentives provided for removal of PI animals
References


6. Fux RG, RG Fux. 2007. *Development and evaluation of diagnostic methods for detecting bovine viral diarrhea virus in dried ear biopsy samples using antigen-ELISAs and real-time RT-PCR [dissertation]*. University of Munich Veterinary Department, Munich, Germany.


8. EU Thematic network on control of bovine viral diarrhoea virus (BVDV) BVDV Control QLRT – 2001-01573


Thank You
Back Up
How Can BVDV Survive in the Herd?

- BVDV free herd
- Dam with fetus
- PI animal
Trade, fence to fence contact
Cow dies from MD (Mucosal Disease)
Other herd - BVDV free