Johne’s Disease (JD) – Challenges and Opportunities

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The cause:
Mycobacterium avium paratuberculosis

The result: Damaged intestine

Chronic, contagious infection with a longed incubation period

Median incubation period = 5 years

Presentation Summary

- JD is common & spreading
- JD limits milk production
- Prevention and control of JD is practical and affordable by:
  - Improvements in calf rearing
  - Testing to find the most infectious cows for culling
- JD control methods improve herd health
- JD control improves milk quality
- The proposed DFO program is scientifically sound & comparable to the Dutch and Danish programs and international recommendations
...results suggest that at least one-fourth of U.S. dairy operations may have a relatively high percentage of infected cows in their herds.

Ontario: 20-40% herds infected
(informal estimates only - no scientific surveys)


Take home message:
You have choices what to do, but you must do SOMETHING!

ELISA results predict milk loss

Johne's is common & spreading

Johne's spreads within herds!

Johne's decreases milk production
Production Parameter by ELISA Result Category

<table>
<thead>
<tr>
<th>Production Parameter</th>
<th>ELISA Result</th>
<th>21,327 lb\textsuperscript{a}</th>
<th>18,631 lb\textsuperscript{b}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative, Low-positive Positive</td>
<td>(9,694 Kg)</td>
<td>(8,467 Kg)</td>
</tr>
<tr>
<td></td>
<td>High (Strong) Positive</td>
<td><strong>\textsuperscript{-1,225 Kg}</strong></td>
<td>\textsuperscript{a}</td>
</tr>
<tr>
<td></td>
<td><strong>\textsuperscript{b}</strong></td>
<td>\textsuperscript{a}</td>
<td></td>
</tr>
</tbody>
</table>

Row values with different subscripts are significantly different p<0.05.

Control programs must be justified based on the producer’s bottom line.

The objective is to put paratuberculosis out of business, not the producer.

A test not used is not a useful test.

Decision analysis incorporates economics into control program design

Optimal Program: Typical Herd (100 cows 10% infected)

Control Programs - Do They Work?
Reducing Theory to Practice

Management changes together with ELISA testing can control Johne’s disease.

Evaluation

- Compare rate of infection in animals born before and after start of the Johne’s disease control program

- Control program:
  - Herd management + herd testing

ELISA-pos prevalence at the start

9.8% to 20.9%

Demo Herd Locations

Project Manager

Dr. Vic Eggleston
32 years experience as bovine practitioner
Past president WVMA

Project Program:
Simple, Affordable, Two-Steps

- **Step #1: Hygiene**
  - Stop new infections: focus on heifer rearing.

- **Step #2: Testing**
  - Label high risk cattle.
    - Segregated calving area
    - Do not use as colostrum donors
  - Cull only the most heavily infected cows – those not likely to survive another lactation.
Step #1: Just Four Things to Do

1. Prompt calf removal from cow.
   While still wet; before standing to nurse.
2. Feed 4 qt. high quality colostrum in <6hr.
   One cow to one calf: from test-negative cow.
3. Feed pasteurized milk until weaning.
   Milk replacer or on-farm pasteurizer.
4. Hygienic rearing system.
   Feed and water free from manure contamination.

Step #2: Test-and-Manage

✓ Test all cows once in each lactation.
✓ Label ELISA-positive or “suspect” cows.
✓ Only use colostrum from ELISA-negative cows.
✓ Use separate maternity pen for ELISA-negative cows.

Methods Used to Label ELISA-pos Cows

Quantitative ELISA Based Management Decisions

<table>
<thead>
<tr>
<th>S/P</th>
<th>Interp.</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.10</td>
<td>Negative</td>
<td>Keep for another lactation</td>
</tr>
<tr>
<td>0.10 – 0.25</td>
<td>Suspect</td>
<td>Keep – but do NOT use colostrum</td>
</tr>
<tr>
<td>0.25 – 0.40</td>
<td>Low pos</td>
<td>Keep – unless other reasons to cull</td>
</tr>
<tr>
<td>0.40 – 1.00</td>
<td>Positive</td>
<td>Cull – unless good reasons to keep</td>
</tr>
<tr>
<td>&gt; 1.00</td>
<td>High pos</td>
<td>Null at dry-off: mandatory</td>
</tr>
</tbody>
</table>

Do not use colostrum or milk from ANY suspect or positive!

Objective of Testing

Interrupt transmission from the MOST infectious to the MOST susceptible MOST of the time (“most” refers to probabilities)

Perfect tests are not affordable. Affordable tests are not perfect.

Read Hoard’s Dairyman April 25, 2008

Percent ELISA-positive

As of January 1, 2007

Before

After

All herds combined: 1st lactation cows only

104/1012 (10.6%)

50/1586 (3.2%)

Significant; p<0.001
Conclusions So Far

- The program is successful
  - Decreased test-positives
  - Stopped clinical cases of Johne’s
  - Satisfied dairy producers

- Some herds are controlling Johne’s faster than others

- The veterinarian is critical to use diagnostics effectively and keep the program on track.

ELISAs For Paratuberculosis

<table>
<thead>
<tr>
<th>“Score” Range</th>
<th>Infected cows</th>
<th>Non-infected cows</th>
<th>LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.000</td>
<td>214</td>
<td>314</td>
<td>0.62</td>
</tr>
<tr>
<td>0.00 - 0.049</td>
<td>46</td>
<td>87</td>
<td>0.48</td>
</tr>
<tr>
<td>0.05 - 0.099</td>
<td>16</td>
<td>2</td>
<td>7.34</td>
</tr>
<tr>
<td>0.10 - 0.149</td>
<td>12</td>
<td>1</td>
<td>11.0</td>
</tr>
<tr>
<td>≥0.150</td>
<td>87</td>
<td>0</td>
<td>∞</td>
</tr>
<tr>
<td>Total</td>
<td>375</td>
<td>404</td>
<td></td>
</tr>
</tbody>
</table>

**AntelBio recommended cutoff = 0.100**

**Likelihood Ratios: Antel Milk ELISA**

(odds of being a fecal shedder of M. paratuberculosis)

12 of 21 (57%) cull dairy cows confirmed MAP-infected had no clinical evidence of Johne’s disease.

Antognoli et al. Veterinary Microbiology 127:300, 2008

**Johne’s tests are accurate & affordable**

**Size matters**

Not all Johne’s cows are thin.

IDEXX ELISA S/P = 2.0 = Strong-positive
Reasons to Cull ELISA Strong-Positive Cows

- Likely to go clinical next lactation
- Likely not to complete a full lactation
- Decreased production next lactation
- Likely carrying an infected fetus if PG
- Heavy shedders = highly infectious
- Will contaminate maternity pen causing more infected heifers.

What Other Countries Are Doing

Building infrastructure to improve dairy cattle health plus protect export and local markets.

U.S. Investment

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Investment</th>
<th>Cumulative Investment Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>$20,000,000</td>
<td>$20,000,000</td>
</tr>
<tr>
<td>2002</td>
<td>$40,000,000</td>
<td>$60,000,000</td>
</tr>
<tr>
<td>2003</td>
<td>$60,000,000</td>
<td>$120,000,000</td>
</tr>
<tr>
<td>2004</td>
<td>$80,000,000</td>
<td>$200,000,000</td>
</tr>
<tr>
<td>2005</td>
<td>$100,000,000</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>$120,000,000</td>
<td></td>
</tr>
</tbody>
</table>

Expenditures only to operate the JD program; excludes all research, e.g. JDIP >$8,000,000.

Program Specifications

- Nationally coordinated
- State administered.

Main Elements of the National Program

- Education
- Herd Testing and Classification
- Herd Management

U.S. Voluntary Bovine Johne's Disease Control Program

Test-positive herds

- Test Positive Component
  - Level 1: Whole herd test with ≥50% test-positive; or 1 test-positive animal
  - Level 2: Whole herd test with ≥35% test-positive
  - Level 3: Whole herd test with ≥15% test-positive
  - Level 4: Test positive herd cannot be in the test negative herd program; test negative herd addition rules will apply

Test-negative herds

- Test Negative Component
  - Level 1: ++5% confidence herd is noninfected
  - Level 2: +45% confidence herd is noninfected
  - Level 3: +45% confidence herd is noninfected
  - Level 4: +45% confidence herd is noninfected

Education:

- Herd Management
- Herd Classification requires RAMP and testing
- Level A: Whole herd test with <5% test-positive
- Level B: Whole herd test with 5-15% test-positive
- Level C: Whole herd test with <5% test-positive
- Level D: Whole herd test with >15% test-positive
- Level E: Screening test of 30 cattle, 2nd lactation >36 mo. old, or environmental testing of premises for calcium
Industry In Charge of its Own Destiny
Tillamook “Raises the Bar”

#33 largest co-op in the U.S.
Member milk volume 583,000 lbs.
Member farms = 140
Requires all members to participate in the National Johne’s Disease Program

New ParaTB Program
“Milk Quality Assurance Program”
Effective January 2008

- Classify all herds by serum or milk ELISA:
  - Status A herds: test-negative
  - Status B herds: test-positive but pos cows culled
  - Status C herds: test-positive cows remain in herd
- Dairy processor pays 100% testing costs
- If herds use pTB preventive management practices
- By 2010 all Dutch dairy herds must participate
- By 2011 all herds delivering milk must be status A or B

Kongeåprojektet
Danish Dairy Board
DKr 100,000,000
100 herds studied 5 years
5 PhD students studied Johne’s disease

“Operation Paratuberculosis”
Started February 2006 and now has >2,000 dairy producers enrolled.
Risk-based on-farm controls + Milk ELISA testing

Danish statement:
Testing without managing costs producers more money than doing nothing.

The Farm is the Critical Control Point

- Improves the quality of the raw product.
  - Potentially eliminates the need to change processing.
- Added bonus:
  - Improves health and welfare of the animal.
  - Improves the efficiency and profitability of the dairy.

We Have the Tools – Time to Use Them
Place multiple hurdles between MAP source and calves or consumers

- Prevent infection of herds
- Limit infection spread on farms
- Test herds and cull positive cattle
- Collect meat and milk hygienically
- Pasteurize all dairy products

Food safety: “teat to tongue” or “moo to you”
Five Reasons to Control Johne’s

1. JD is a production limiting disease
2. JD is an infectious disease (spreading)
3. JD tests for are accurate and affordable
4. JD control improves overall herd health
5. The Ontario program is scientifically sound, timely, and the “right thing to do”.

Questions?