“The Impact of Diseases on the Beef Production Chain”

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Within the next ten years the open range was gone, and Florida cattle ranching underwent pervasive changes.

Disappearance of the Open Range

Our second objective is to examine the abrupt disappearance of the open range in peninsular Florida between 1940 and 1950. In so doing we hope to fill what seems to be a partial void in our understanding of Florida’s recent development.

The decline of Florida’s Cuban market was clear-cut by 1920. We suspect that long-term increases in shipments from other Caribbean
Top 50 foods in the world

• The world produces 8.9 billions tons of food commodities (top 50).
• Sugar cane accounts for roughly 21% of the food commodities produced in the world (top 50).

FAOSTAT 2013
Where does beef appear in the list?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Commodity</th>
<th>Tonnes</th>
<th>% Of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sugar cane</td>
<td>1,898,206,534</td>
<td>21.35%</td>
</tr>
<tr>
<td>2</td>
<td>Corn</td>
<td>1,017,536,854</td>
<td>11.45%</td>
</tr>
<tr>
<td>26</td>
<td>Eggs, hen</td>
<td>68,362,486</td>
<td>0.77%</td>
</tr>
<tr>
<td>27</td>
<td>Beef</td>
<td>63,261,528</td>
<td>0.71%</td>
</tr>
<tr>
<td>28</td>
<td>Coconuts</td>
<td>62,185,313</td>
<td>0.70%</td>
</tr>
<tr>
<td>7</td>
<td>Vegetables, fresh</td>
<td>279,740,040</td>
<td>3.15%</td>
</tr>
<tr>
<td>8</td>
<td>Soybeans</td>
<td>278,092,981</td>
<td>3.13%</td>
</tr>
<tr>
<td>9</td>
<td>Cassava</td>
<td>263,314,862</td>
<td>2.96%</td>
</tr>
<tr>
<td>10</td>
<td>Sugar beet</td>
<td>247,382,251</td>
<td>2.78%</td>
</tr>
<tr>
<td>11</td>
<td>Tomatoes</td>
<td>163,434,041</td>
<td>1.84%</td>
</tr>
<tr>
<td>12</td>
<td>Barley</td>
<td>143,600,051</td>
<td>1.62%</td>
</tr>
<tr>
<td>13</td>
<td>Pork</td>
<td>112,333,009</td>
<td>1.26%</td>
</tr>
<tr>
<td>14</td>
<td>Watermelons</td>
<td>108,932,567</td>
<td>1.23%</td>
</tr>
<tr>
<td>15</td>
<td>Bananas</td>
<td>105,956,705</td>
<td>1.19%</td>
</tr>
</tbody>
</table>

FAOSTAT 2013
Where does the **world’s cattle meat** come from?

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
<th>Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>18%</td>
<td>11-12 million</td>
</tr>
<tr>
<td>Brazil</td>
<td>16.8%</td>
<td>9.9 million</td>
</tr>
<tr>
<td>EU</td>
<td>13%</td>
<td>10 million</td>
</tr>
<tr>
<td>Mainland China</td>
<td>9.8%</td>
<td>5 million</td>
</tr>
<tr>
<td>Africa</td>
<td>8.6%</td>
<td>5.5 million</td>
</tr>
<tr>
<td>India</td>
<td>6.8%</td>
<td>3.9 million</td>
</tr>
<tr>
<td>Argentina</td>
<td>4.7%</td>
<td>2.8 million</td>
</tr>
<tr>
<td>Australia</td>
<td>3.3%</td>
<td>2.1 million</td>
</tr>
<tr>
<td>Russia</td>
<td>2.5%</td>
<td>1.6 million</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>13%</td>
<td>10 million</td>
</tr>
</tbody>
</table>

US Department of Agriculture and the FAO (Food and Agriculture Organisation.)
The Iceberg Principle and Disease
Iceberg effect... and disease

- In an outbreak... more animals in the herd are subclinical or silent cases than there are clinical cases.
- With both infectious and non-infectious health problems, the ratio between clinical cases and subclinical cases is typically 1:5 to 1:20.
• For most infectious diseases.....within a herd
• the single largest risk factor for acquiring an infectious disease within the herd is the introduction of sub clinically infected animals that are carrying the infectious agent.
Infectious Disease Within a Herd

- A number of infectious agents are endemic within a herd.
  - meaning that they are active in most herds
  - most animals in the herd become infected
  - develop immunity to the agents at some point in their life with ........no clinical signs
  - In most herds young animals acquire silent subclinical infections and develop protective immunity......with no or few clinical signs!
So............

Is it easy to spot the sick ones?
Let's Take a LOOK

- Cattle are prey animals so id of sick animal can be difficult
- Wittum study of animals with BRD in a feed yard, \((5,976 \text{ hd})\)
  - All calves were monitored by experienced feedlot personnel
    - BRD was observed at a rate of 8.17%
      - Lung lesions at slaughter were present in 62% of animals
    - Total incidence of BRD in treated and untreated 64.4%

Wittum and the economics of lost performance due to BRD

- Noted a decrease in
  - ADG during the acclimation period (0.37 ± 0.03 kg) (.81 lbs)
  - Overall test period (0.07 ± 0.01 kg) .15 lbs X 135 days = 20.25 lbs @ $1.37=$27.74 for the feeding period
  - Reduced HCW 8.16 kg ± 1.38 kg X ($203.50/cwt ) = $36.54 loss
  - Marbling score decrease of 0.13 ±0.04

- The adverse effects on production traits tended to increase as the number of treatments increased
  - $23.23 treated once compared to never treated ($67.00)
  - $30.15 treated twice compared to never treated ($88.20)
  - $54.01 treated 3 time compared to never treated($157.96)
BRD and Clinical Observations... finding the sick ones!!!!!

- Wittum Study 2..........
  - 469 steers followed from birth to harvest
    - 35% received treatment for resp disease
    - 29% exclusively at the yard
  - At slaughter 72% had gross lung lesions
  - 68% of steers with lung lesions were never treated

- Study 3
  - Thompson found that animals with lung lesions at slaughter 69.5% had never been treated for BRD.

Moral of the Story

We do not have a reliable means of identifying sick cattle due to BRD in a feedlot setting.
Performance...... Iceberg Effect

• Subclinical disease is robbing your herd!
  • You just may not know it!!!!

• This THEFT can occur through
  • Adverse herd health
  • Poor management / husbandry
  • Improper nutrition
  • Often a combination of several contributing factors
create disease within a herd requires interaction between 3 components

HOST

ENVIROMENT  AGENT
HOST FACTORS

• Immune Status
  • Initial vaccination history
  • MLV vs Killed?
  • Boosters.....?
• Vaccination History
  • Toxoid adm.....
• Initial vaccination history
  • Colostrum quantity/quality
• Age of Dam
• Age
  • Neonate
  • Adult cow or bull
• Nutritional state of dam
  • BCS 2/3 vs 5/6
• Micro mineral status
• Concurrent Diseases
  • Parasites
• Genetic makeup of the animal
• Past exposure
• Forage quality & availability
• Micro mineral supplementation
• Time of year
  • Dead of winter in Kansas
  • Heat of summer in south Florida
• Closed Herd
• Open herd, with no biosecurity (New additions)
• Went through a sale barn
• Grazing system
• Stocking rate
• Herd husbandry

ENVIRONMENTAL FACTORS
AGENT FACTORS

- Pathogenicity of the agent
  - FMD vs. PI3
- Antigenic diversity
  - Anaplasmosis organism
- Is vaccination protective against agent?
- Length of shedding of the Organism
  - BVD PI
- Immune response Virus vs Bacteria
- Survival outside of the host
  - Virus vs spore Anthrax or Cl
  - Wildlife reservoir???
- Incubation period........
  - Johne’s (years)
  - IBR days
    - Latent infections with herpes virus
- Replication rate
Things are not just Black and White when considering the health and related performance of the herd. There are a lot of confounders and what if’s...
BEEF (the food) Production Chain and information flow back up the Chain

- Seed stock producer
- Cow calf producer
- Stocker / Backgrounder
- Fed cattle
- Processing
- Wholesale
- Retail

Consumer
Animal Health and Beef Cattle Production chain influencers

- Seedstock
- Cow Calf producer
- Stocker / backgrounder
- Fed cattle
- Packer
- Wholesale
- Retail

#1 influencer is the cow calf producer
The Cattle Production Pyramid

- Cow Calf
- Feedlot Production
The Cattle Production Pyramid

Feedlot
Production

Cow Calf
Minimizing the influence of ADVERSE HEALTH on Beef Production

Develop the calf while they are on (in) the cow.

To have a healthy and productive calf....... you have to have a healthy cow!
Foundation for Animal Health - Beef Production - Herd Economics is the COW HERD!

- Reproductive efficiency $$$$$$$$$
  - Is the most significant factor that drives the success of a cow calf business.
  - Many things that affect reproductive efficiency
    - Nutrition
      - Grass, nutritional supplements, timing
    - Genetics
      - Animal type and environment
Beef Cattle Health and Production Is Grounded in the cow herd.

• Breeding programs
  • AI vs. natural
  • Length of breeding season
• Health programs
  • Herd health programs
  • Additions
  • Biosecurity
• Husbandry of the Herd
A Closer LOOK................Animal Health
Getting started
Right........................!!!
To produce a **Healthy Calf**

- We have to have a **Healthy Cow**............
  - #1 ingredient is adequate nutrition for a beef cow which is critical in ensuring;
    - normal fetal growth
    - calf survivability
    - adequate calf growth
    - postpartum breeding efficiency
    - short calving interval
    - quality colostrum
    - effective immune response
    - ..............................................................
Use of reproductive vaccines by cow/calf operations.

<table>
<thead>
<tr>
<th>Type of vaccine</th>
<th>Use in weaned heifers (%)</th>
<th>Used in pregnant heifers (%)</th>
<th>Use in cows (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious bovine Rhinotracheitis</td>
<td>19.4</td>
<td>11.9</td>
<td>24.6</td>
</tr>
<tr>
<td>BVDV</td>
<td>25.1</td>
<td>13.7</td>
<td>28.1</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>12.6</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>Leptospira</td>
<td>19.9</td>
<td>15.1</td>
<td>37.1</td>
</tr>
<tr>
<td>Brucella abortus</td>
<td>14.8</td>
<td>2.8</td>
<td>1</td>
</tr>
<tr>
<td>Histophilus somni</td>
<td>9.3</td>
<td>5.3</td>
<td>7.9</td>
</tr>
<tr>
<td>Neospora</td>
<td>--</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Tritrichomonas</td>
<td>0.7</td>
<td>0.9</td>
<td>1</td>
</tr>
</tbody>
</table>

National animal health monitoring, Beef 2007-08 part IV, Beef cow calf management practices in the United States, 2007-08, Fort Collins Co. USDA 2009
U.S. Calf Mortality

- Of all beef calves born 6.5% are born dead or died before weaning.
- Of this 6.5%:
  - 44.6% born dead
  - 55% of others who died
    - 1/3 prior to 24 hrs. of life
    - 1/3 for >24 hrs. to 3 weeks
    - 1/3 from 3 weeks to just prior to weaning

NAHMS 2008 cow calf
### NAHMS 2007-2008

Calf Mortality % or mortalities by etiology

<table>
<thead>
<tr>
<th>cause</th>
<th>&lt; 3wks old</th>
<th>3 wks and older</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestive</td>
<td>14</td>
<td>22.6</td>
</tr>
<tr>
<td>Respiratory</td>
<td>8.2</td>
<td>31.4</td>
</tr>
<tr>
<td>Metabolic</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Lameness / Injury</td>
<td>1.5</td>
<td>4.4</td>
</tr>
<tr>
<td>Birth Related</td>
<td>25.7</td>
<td>2.3</td>
</tr>
<tr>
<td>Other knows diseases</td>
<td>0.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Weather</td>
<td>25.6</td>
<td>10</td>
</tr>
<tr>
<td>Poisoning</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>Predator</td>
<td>4.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Theft</td>
<td>0.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Other known causes</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Unknown</td>
<td>18.6</td>
<td>19.4</td>
</tr>
</tbody>
</table>
Getting a good start!

- Avoid Dystocia and Fetal Stress
  - Stressed calves take longer to stand and suckle
  - Following a normal delivery, a calf will be standing within $32 \pm 20$ minutes and will be nursing within $60 \pm 27$ minutes.
- A calf which is assisted at birth will often be, anorexic, weak and slow. Calves born with assisted deliveries will generally be standing within $90 \pm 78$ minutes and be nursing within $138 \pm 100$ minutes.
- Dystocia resulting in poor newborn calf vitality is a major cause of failure of passive transfer (FPT) due to low volume of ingested colostrum.
Adequate Colostrum Consumption

• colostrum consumption by a calf has a significant impact on the future health and performance of that calf.
  • Calves identified as having failure of passive transfer were at greater risk (OR 3.2) of mortality from birth to weaning
  • greater risk for feedlot respiratory morbidity (OR 3.1)
  • Lower weaning weights are observed in calves identified as having failure of passive transfer
    • due to higher morbidity during the first 28 days of life which resulted in weaning weights being 35 pounds lower than expected.  

Passive Immunity & a Calf’s immune response

- The response to vaccination of a young calf is affected by both its passive immune status i.e. absorbed maternal antibody and by the specific antigens in question.

- By one hundred days of age, 97% of the maternal antibody received by the calf through colostrum is gone.

- Immunological dogma that passively acquired maternal antibodies can inhibit the immune responses in calves appears to be somewhat true for the humoral immune response, but not true for the cell mediated immunity.
  - By approximately 2 weeks of age, calves have cell-mediated immune response levels similar to that of adults.

Micro Mineral Nutrition and Calf Health
Healthy Cows… Getting Started Right (2,008) herds

<table>
<thead>
<tr>
<th>Herd Status</th>
<th>Copper</th>
<th>Zinc</th>
<th>Selenium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perinatal mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3.98&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.82&lt;sup&gt;c&lt;/sup&gt;</td>
<td>30.77&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>3.63&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.76&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.48&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vaccination Failure&lt;sup&gt;2&lt;/sup&gt;</td>
<td>5.05&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td>15.37&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Myopathy&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td>77.5&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Heart Failure&lt;sup&gt;2&lt;/sup&gt;</td>
<td>9.41&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.45&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> beef and dairy herds
<sup>2</sup> beef herds

<sup>a</sup>P<0.10, <sup>b</sup>P<0.05, <sup>c</sup>P<0.01, <sup>d</sup>P<0.01

BRD.....#1 Problem in Stocker and Fed Cattle

- Control of diseases within the calf crop, with the most important being Bovine Respiratory Disease, begins during the CALVING SEASON with management that optimizes passive transfer of clostridial antibodies.

- Following that
  - Proper Nutrition
  - Sound Vaccination Programs
  - Stress Management
    - Weaning,
    - Transport and Handling
  - Backgrounding if possible
  - Minimize time spent in marketing channels
    - Minimize commingling

- All become part of BRD management program.
So what......

• A cattle buyer with no known history of cattle will assume them to be average

• In the case of vaccinations 25% of all operations vaccinated against virus associated with BRD at some point prior to weaning.

• Of that 25% whom vaccinated--- half utilize killed vaccines with 1/3 of these animals being properly boostered.

• Therefore less than 20% of operations adequately vaccinate against BRD prior to weaning. As such an order buyer will assume that a calf has a less than a one in five chance of being properly immunized.

• Probability of getting sick once they own them increases
  • Will experience associated Production losses
Production Losses due to BRD

• It has been estimated that the operating costs for feeding a group of properly prepared calves is reduced by 12% (above the purchase price) compared to calves of unknown origin
  • Less number of rations
  • Decreased mill time
  • Fewer feed trucks
  • Less feeding time
  • Reduced labor
The Cattle Production Pyramid

Cow Calf

Feedlot Production
BRD and cost of production

• So what do we know
  • For pens of cattle
    • As % of cattle within a pen are treated for BRD
      • DMI is significantly impacted $p<0.001$
      • ADG is significantly impacted $p<0.001$
      • Feed to gain is impacted $p=0.08$

Erickson G. et al.  Relationship between Morbidity and Performance in Feedlot cattle, 2011 Nebraska Beef Cattle Report
At the pen level (978 lots) (276,116 head)
Cattle on feed in Alberta Canada

Erickson G. et al.  Relationship between Morbidity and Performance in Feedlot cattle, 2011 Nebraska Beef Cattle Report
Morbidity & Relationship with DMI and ADG $p<0.001$

Erickson G. et al. Relationship between Morbidity and Performance in Feedlot cattle, 2011
Nebraska Beef Cattle Report
# Morbidity and Carcass Characteristics

<table>
<thead>
<tr>
<th>Respiratory Disease treatment</th>
<th>0</th>
<th>1</th>
<th>2+</th>
<th>SEM</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>steers (n)</td>
<td>30,911</td>
<td>1823</td>
<td>339</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DOF, day</td>
<td>260.4</td>
<td>260.6</td>
<td>260.7</td>
<td>21.4</td>
<td></td>
</tr>
<tr>
<td>Initial BW lb.</td>
<td>630.8</td>
<td>632.6</td>
<td>640.3</td>
<td>29.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Final BW lb.</td>
<td>1377.4</td>
<td>1374.6</td>
<td>1331.2</td>
<td>62.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ADG lb</td>
<td>3.12</td>
<td>3.1</td>
<td>2.94</td>
<td>0.12</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HCW lb</td>
<td>826.4</td>
<td>824.7</td>
<td>798.7</td>
<td>37.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Marbling</td>
<td>516.8</td>
<td>503</td>
<td>489.8</td>
<td>13</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LM area in2</td>
<td>12.7</td>
<td>12.7</td>
<td>12.4</td>
<td>0.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>fat dept in</td>
<td>0.42</td>
<td>0.4</td>
<td>0.37</td>
<td>0.03</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>USDA choice %</td>
<td>51.3</td>
<td>42.1</td>
<td>36.9</td>
<td>0.07</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>USDA YG</td>
<td>3.17</td>
<td>3.1</td>
<td>3.04</td>
<td>0.11</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Erickson G. et al. Relationship between Morbidity and Performance in Feedlot cattle, 2011
Nebraska Beef Cattle Report
ICEBERG and BVD.................
BVDV

• Several syndromes recognized
  • Acute BVD & associated resp disease
  • Persistently Infected animal (PI)
  • Mucosal Disease
  • Haemorrhagic disease
  • Reproductive Loss
  • Abortions
  • Immunosuppression
BVDv

BVDv suppresses the innate and adaptive immune components which enables infections from secondary pathogens.
BVDv

The majority of BVDV infections proceed sub clinically.
## Prevalence of PI animals

<table>
<thead>
<tr>
<th>State</th>
<th>No of Cattle</th>
<th>Prevalence of PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>403</td>
<td>2.0%</td>
</tr>
<tr>
<td>North Carolina</td>
<td>850</td>
<td>0.47</td>
</tr>
<tr>
<td>Florida</td>
<td>1,930</td>
<td>0.16</td>
</tr>
<tr>
<td>Kentucky</td>
<td>416</td>
<td>0.24</td>
</tr>
<tr>
<td>Missouri</td>
<td>1323</td>
<td>0.15</td>
</tr>
<tr>
<td>Mississippi</td>
<td>756</td>
<td>0.13</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>8,184</td>
<td>0.51</td>
</tr>
<tr>
<td>Tennessee</td>
<td>1,227</td>
<td>0.57</td>
</tr>
<tr>
<td>Texas</td>
<td>5,691</td>
<td>0.26</td>
</tr>
<tr>
<td>Virginia</td>
<td>963</td>
<td>0.31</td>
</tr>
<tr>
<td>Total</td>
<td>21,743</td>
<td>0.40</td>
</tr>
</tbody>
</table>
Health risk of feedlot cattle exposed to a PI

- Transmission of BVDV virus from a PI individual to others occurs, within the herd, on pastures, at the sale barn, in transit, in the feeding pen.
  - Research shows ....
  - The likelihood of an adverse response varies from negative to positive

BVD and PI

We hear a LOT about PI Cattle and their effects on Animal Health and associated Performance
Conclusion

• Based on currently available studies, the direction and magnitude of response of feedlot cattle exposed to BVDV PI cattle cannot be predicted.

• There are a lot of confounders
  • Virulence of the virus, immune status of exposed animals, concurrent exposure to other organism, metabolic or physiologic insults, other unknown risk factors, time between testing and removal and associated animal exposure

Testing Animals for PI??

• Very Confusing Subject!
• WE do have very good tests.......!
• However the incidence of PI animals is extremely low which make interpretation of test results difficult?
• When we consider the sensitivity and specificity of current tests and the prevalence of PI animals we have to consider the positive predictive value for that test!

Testing Animals for PI

• PPV is the probability that the positive result is actually positive
  • For current tests the range in PPV is from 7.8% to 74% PPV
  • When we get a positive result we have two extremes we can consider with that result
    • \textit{1 in 10} chance that the animal is PI
    • \textit{8 in 10} chance the animal is truly positive

Testing Animals for PI..................

• If you do get a test positive animal
• Retest that animal and use the results of the second test as definitive
• If that animal comes back positive
• Test the dam
  • If positive .................. CULL HER FROM THE HERD
• Other Question is what are you going to do with TEST POSITIVE CALVES???
SO..........................