Effects of Bovine Viral Diarrhea Virus (BVDV) Persistently Infected (PI) Calves in the Feedyard and Management of PI Calves after Initial Identification

BVD Control; The Future is Now
January 31, 2006
Denver, Colo.

Bill Hessman DVM
Field Trials

Trial 1

• Feedyard close-out performance comparing PI pens and Non-PI pens (Oct. 2003)

Trial 2

• Starter yard close-out performance comparing differing PI exposure levels. (July 2004)
Trial 1

- Prevalence, Morbidity, Mortality and Performance
- Southeastern, sale barn origin
- 5 Buyers
  - 1 pen removed from study
- PI and Non-PI groups
- 2284 head in 24 pens
- IHC tested at arrival
Results

• **Prevalence Rate**
  – .31% (7 PI animals)

• **Pen Prevalence Rate**
  – 19 Non-PI pens, 5 PI pens
  – 21% (5 of 24 pens placed had at least 1 PI)
    • 2 pens had 2 PI animals

• 5 of 7 PI’s survived to slaughter (71 %)

• 3 of 7 PI’s required antibiotic therapy (43 %)
## Results (cont.)

<table>
<thead>
<tr>
<th></th>
<th># Head</th>
<th>Pens</th>
<th>Wt In</th>
<th>Wt Out Deads In</th>
<th>Wt Gain</th>
<th>DOF</th>
<th>ADG</th>
<th>Consump Dry</th>
<th>F/G Deads In</th>
<th>COG Deads In</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPI</td>
<td>1731</td>
<td>19</td>
<td>571</td>
<td>976</td>
<td>405</td>
<td>180</td>
<td>2.25</td>
<td>14.02</td>
<td>6.26</td>
<td>.691</td>
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<tr>
<td>PI</td>
<td>553</td>
<td>5</td>
<td>574</td>
<td>931</td>
<td>357</td>
<td>177</td>
<td>2.00</td>
<td>13.75</td>
<td>6.94</td>
<td>.767</td>
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<td>P-value</td>
<td>0.04</td>
<td>0.58</td>
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<td>0.53</td>
<td>0.02</td>
<td>0.05</td>
<td></td>
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</tr>
</tbody>
</table>

The table above presents the results of the study with NPI and PI as the treatment groups. The columns include the number of heads (# Head), number of pens (Pens), weight at the beginning (Wt In), weight out of deads at the end (Wt Out Deads In), weight gain (Wt Gain), degree of freedom (DOF), average daily gain (ADG), consump dry (Consump Dry), feed to gain ratio (F/G Deads In), and cost of gain (COG Deads In).
## Results (cont.)

<table>
<thead>
<tr>
<th></th>
<th>% Morb.</th>
<th>1st Relapse Rate</th>
<th>2nd Relapse Rate</th>
<th># of Tx</th>
<th>Med. Cost Per Head</th>
<th>% Mort.</th>
<th>% Railers</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPI</td>
<td>49.52</td>
<td>46.0</td>
<td>55.4</td>
<td>1.72</td>
<td>25.40</td>
<td>6.96</td>
<td>6.34</td>
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<tr>
<td>PI</td>
<td>42.31</td>
<td>43.7</td>
<td>54.8</td>
<td>1.68</td>
<td>23.10</td>
<td>10.37</td>
<td>6.39</td>
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<tr>
<td>p-VALUE</td>
<td>.22</td>
<td>.71</td>
<td>.93</td>
<td>.76</td>
<td>.43</td>
<td>.14</td>
<td>.97</td>
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</table>
**Mortality by DOF**

<table>
<thead>
<tr>
<th>DOF Range</th>
<th>PI</th>
<th>%</th>
<th>DIFF</th>
<th>NPI</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 31 DOF</td>
<td>4.95</td>
<td>+144</td>
<td>5.03</td>
<td>2.03</td>
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<tr>
<td>&lt; 61 DOF</td>
<td>9.23</td>
<td>+83</td>
<td>5.03</td>
<td>5.03</td>
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<tr>
<td>&lt; 91 DOF</td>
<td>9.91</td>
<td>+69</td>
<td>5.88</td>
<td>5.88</td>
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<tr>
<td>&lt; 121 DOF</td>
<td>10.0</td>
<td>+56</td>
<td>6.43</td>
<td>6.43</td>
<td></td>
</tr>
<tr>
<td>&lt; 151 DOF</td>
<td>10.1</td>
<td>+51</td>
<td>6.68</td>
<td>6.68</td>
<td></td>
</tr>
<tr>
<td>Close Out</td>
<td>10.3</td>
<td>+49</td>
<td>6.90</td>
<td>6.90</td>
<td></td>
</tr>
</tbody>
</table>
Effect of PI on BRD mortality versus No PI: Days on Feed

- 553 cattle with PI exposure
- 1731 cattle with no PI exposure
  - 31 DOF: $P<0.0001$
  - 61 DOF: $P=0.0007$
  - 91 DOF: $P=0.0008$
  - 121 DOF: $P=0.0022$
  - 151 DOF: $P=0.0027$
  - Closeout: $P=0.0019$
Trial 2

Evaluate the Effects of Persistent Infection with BVDV on Morbidity, Mortality and Performance in High Risk Feedlot Cattle.
Investigators

Bill Hessman DVM
Dave Sjeklocha DVM
Tim Murphy PhD
Robert Fulton DVM, PhD
Julia Ridpath PhD
Mark Payton PhD
Cattle Empire Trial

• **Starter Phase (60 days)**
  – July 1, 2004
  – New Starter yard (10,000 head)
  – 5 cwt
  – Southeastern sale barn origin
  – Limit fed
  – Not implanted
Testing and Confirmation

- Tested 21,743 head in 240 pens
- BVD PI test by Antigen Capture Elisa by ear notch on arrival by Haskell County Animal Hospital, Sublette, Ks.
  - Positive tests confirmed by Dr. Fulton at OSU
    - Ag Capture
    - IHC
    - PCR
    - VI
    - Viruses subtyped by sequencing of 5’ UTR at USDA (Ridpath)
Processing

• On arrival
  – 5-way viral (MLV BHV 1, PI3, BRSV, killed BVD 1a and BVD 2a)
  – *Mannheimia* and *Pasteurella*
  – Dewormer
  – Clostridial
  – Metaphylactic Injection
  – Individual Identification and weighed

• Re-vaccination (day 10)
  – 5-way viral (MLV BHV 1, PI3, BRSV, BVD 1a and 2a)
Treatment Group Classification

- **PI**
  - PI animal at arrival and left in pen
- **PIR**
  - PI animal at arrival and removed to quarantine pen
- **NPIE**
  - No PI animal at arrival, placed next to a PI pen
- **NPIER**
  - No PI animal at arrival, placed next to a PIR pen
- **NPIU**
  - No PI animal at arrival and remained totally unexposed
Trial 2: Evaluate the Effects of Persistent Infection with BVDV on Morbidity, Mortality and Performance in High Risk Feedlot Cattle: Performance

- Weight Gain
- Feed Gain Dry M
- Average Daily Gain
- Cost of Gain
- Morbidity %
- # 1st Pulls
- # 2nd Pulls
- Relapse rate 1st
- # 3rd Pulls
- Relapse rate 2nd
- # 4th Pulls
- Relapse rate 3rd
- Railer %
- Mortality %
- Treatment cost
- # treatments
Cattle Empire
BVD Trial

ALLEY 1-LEAVE PI’S IN
ALLEY 2-REMOVE PI’S
ALLEY 3-REMOVE PI’S

PI PENS
NPIE PENS
PIR PENS
NPIER PENS
NPIU PENS
QUARANTINE PENS
PI Animal Removal

- Ag Capture test ran daily
- Positive animals pulled from pen within 48 hrs of processing for re-sampling. Positives in alley 1 (PI) returned to pen. Positives in alley’s 2 & 3 (PIR) removed to quarantine.
  - Follow-up samples for Dr. Fulton
    - Notch in PBS
    - Notch in formalin
    - Serum samples
    - Nasal swabs
- Animals in quarantine were not re-vaccinated or treated for health issues.
Quarantine Pens
Analysis

• 21,743 animals tested in 240 pens/lots
• Analysis based on:
  – Pens with majority of DOF at highest risk
    – 214 pens with 19,336 head eligible for analysis
  – **Outliers removed (COG deads in outcome)**
    – 207 pens with 18,765 head eligible for analysis
  – Pens with no status change throughout starter phase
    – 167 pens with 15,348 head eligible for analysis
  – **Outliers removed (COG deads in outcome)**
    – 163 pens with 15,058 head eligible for analysis
Statistical analysis

• Analysis of variance procedures conducted on all response variables using PROC MIXED in PC SAS Versions 9.
• Pairwise t-tests (LSMEANS) statement with DIFF option to determine differences in status.
• Significance level of 0.05 was used for all comparisons
Ineligibility

• Pens removed from analysis
  – One lot of cattle placed in 2 pens with different status
    • Feedyard close-out data based on lot
  – Missing sample at processing
    • Dead on truck and not tested
  – 2 loads for 1 lot arriving at different date with PI in last load.
PI Prevalence Rate

- 88 Antigen Capture positives at HCAH
  - 2 animals subsequently found to be acutely infected
  - 86 true PI’s of 21,743
    - Prevalence rate of .40%

- 74 pens PI positive (240 pens tested)
  - Positive pen rate of 31%

- 67 pens PI positive (pens with no status change and outliers removed)
  - Positive pen rate of 41%
PI Survival Rate

• 22/86 (25.6%) Died during starter phase
  – Cause of death
    • 14/22 (64%) Mucosal Disease
    • 6/22 (27%) Respiratory
    • 1/22 (4.5%) Other
    • 1/22 (4.5%) Bloat

• 4/37 (10.8%) Railed from PI pens-starter phase

• 43/86 (50%) Survival Rate - Sold to slaughter or railed light
PI Virus Subtypes

- BVDV 1b 77.9%
- BVDV 1a 11.6%
- BVDV 2 10.5%
## Results – Performance Summary

**PENS WITH NO STATUS CHANGE**  
**OUTLIERS REMOVED**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>PENS</th>
<th>WT GAIN D IN</th>
<th>F/G DRY D IN</th>
<th>ADG D IN</th>
<th>COG D IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>32</td>
<td>78&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.25&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.63&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>PIR</td>
<td>35</td>
<td>87&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>8.27&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>1.36&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>1.22&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>NPIE</td>
<td>17</td>
<td>93&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.27&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.49&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>1.02&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>NPIER</td>
<td>16</td>
<td>105&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>6.57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.61&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.91&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>NPIU</td>
<td>63</td>
<td>111&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.44&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.65&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.89&lt;sup&gt;b&lt;/sup&gt;</td>
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</tbody>
</table>
# Results – Health Summary

**PENS WITH NO STATUS CHANGE**

**OUTLIERS REMOVED**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>MORB %</th>
<th>1ST RELAPSE RATE %</th>
<th>RAIL %</th>
<th>MORT %</th>
<th>TX $ / HD</th>
<th>AVG # OF TX’S</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>34.0</td>
<td>46% a</td>
<td>4.5</td>
<td>3.5</td>
<td>16.80 a</td>
<td>1.79 a</td>
</tr>
<tr>
<td>PIR</td>
<td>36.0</td>
<td>43% ab</td>
<td>4.7</td>
<td>2.9</td>
<td>15.84 a</td>
<td>1.73 a</td>
</tr>
<tr>
<td>NPIE</td>
<td>29.2</td>
<td>45% ab</td>
<td>3.6</td>
<td>2.4</td>
<td>16.45 a</td>
<td>1.72 a</td>
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<tr>
<td>NPIER</td>
<td>24.8</td>
<td>35% c</td>
<td>2.7</td>
<td>1.3</td>
<td>14.30 a</td>
<td>1.58 a</td>
</tr>
<tr>
<td>NPIU</td>
<td>28.5</td>
<td>39% bc</td>
<td>2.7</td>
<td>1.6</td>
<td>15.46 a</td>
<td>1.65 a</td>
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</table>
**PI vs PIR and NPIE vs NPIER**

**Performance Outcomes**

Pens with no status change and outliers removed

<table>
<thead>
<tr>
<th></th>
<th>PENS</th>
<th>WT. OUT D IN</th>
<th>WT. GAIN/HD D IN</th>
<th>F/G D IN</th>
<th>ADG D IN</th>
<th>COG D IN</th>
</tr>
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<tr>
<td>PI</td>
<td>32</td>
<td>584</td>
<td>78</td>
<td>11.02</td>
<td>1.25</td>
<td>1.63</td>
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<tr>
<td>PIR</td>
<td>35</td>
<td>585</td>
<td>87</td>
<td>8.27</td>
<td>1.36</td>
<td>1.22</td>
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<td>P-value</td>
<td>0.96</td>
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<td>0.06</td>
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<td>0.07</td>
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<table>
<thead>
<tr>
<th></th>
<th>PENS</th>
<th>WT. OUT D IN</th>
<th>WT. GAIN/HD D IN</th>
<th>F/G D IN</th>
<th>ADG D IN</th>
<th>COG D IN</th>
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</thead>
<tbody>
<tr>
<td>NPIE</td>
<td>17</td>
<td>622</td>
<td>93</td>
<td>7.27</td>
<td>1.49</td>
<td>1.02</td>
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<tr>
<td>NPIER</td>
<td>16</td>
<td>638</td>
<td>105</td>
<td>6.57</td>
<td>1.61</td>
<td>0.91</td>
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<tr>
<td>P-value</td>
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<td>0.27</td>
<td>0.74</td>
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</table>
# PI vs PIR and NPIE vs NPIER

## Health Outcomes

Pens with no status change and outliers removed

<table>
<thead>
<tr>
<th></th>
<th>MORB %</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; RELAPSE</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; RELAPSE</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; RELAPSE</th>
<th>RAIL %</th>
<th>MORT %</th>
<th>TX COST</th>
<th>AVG # OF TX’S</th>
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</thead>
<tbody>
<tr>
<td>PI</td>
<td>33.6</td>
<td>46</td>
<td>58</td>
<td>22</td>
<td>4.52</td>
<td>3.52</td>
<td>16.80</td>
<td>1.79</td>
</tr>
<tr>
<td>PIR</td>
<td>36.1</td>
<td>43</td>
<td>49</td>
<td>26</td>
<td>4.74</td>
<td>2.92</td>
<td>15.84</td>
<td>1.73</td>
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<tr>
<td>P-value</td>
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<td>0.6</td>
<td>0.06</td>
<td>0.06</td>
<td>0.8</td>
<td>0.29</td>
<td>0.39</td>
<td>0.32</td>
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<table>
<thead>
<tr>
<th></th>
<th>MORB %</th>
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<th>2&lt;sup&gt;nd&lt;/sup&gt; RELAPSE</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; RELAPSE</th>
<th>RAIL %</th>
<th>MORT %</th>
<th>TX COST</th>
<th>AVG # OF TX’S</th>
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<tbody>
<tr>
<td>NPIE</td>
<td>29.2</td>
<td>45.3</td>
<td>46</td>
<td>30.4</td>
<td>3.58</td>
<td>2.38</td>
<td>16.45</td>
<td>1.72</td>
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<tr>
<td>NPIER</td>
<td>24.8</td>
<td>35.1</td>
<td>49</td>
<td>23.6</td>
<td>2.68</td>
<td>1.27</td>
<td>14.30</td>
<td>1.58</td>
</tr>
<tr>
<td>P-value</td>
<td>0.32</td>
<td>0.03</td>
<td>0.66</td>
<td>0.48</td>
<td>0.45</td>
<td>0.18</td>
<td>0.19</td>
<td>0.13</td>
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</tbody>
</table>

P-values for comparison:
- PI vs PIR: 0.4, 0.6, 0.06, 0.06, 0.8, 0.29, 0.39, 0.32
- NPIE vs NPIER: 0.32, 0.03, 0.66, 0.48, 0.45, 0.18, 0.19, 0.13
# Biologic Groups
## Performance Outcomes

P{s} with no status change and outliers removed

<table>
<thead>
<tr>
<th>TREATMENT GROUP</th>
<th>PENS</th>
<th>WT GAIN D IN</th>
<th>F/G D IN</th>
<th>ADG D IN</th>
<th>COG D IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI &amp; NPIE</td>
<td>49</td>
<td>83</td>
<td>9.72</td>
<td>1.33</td>
<td>1.42</td>
</tr>
<tr>
<td>PIR &amp; NPIER</td>
<td>51</td>
<td>93</td>
<td>7.74</td>
<td>1.44</td>
<td>1.12</td>
</tr>
<tr>
<td>P-VALUE</td>
<td>.09</td>
<td>.17</td>
<td>.11</td>
<td>.18</td>
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## Biologic Groups

### Health Outcomes

Pens with no status change and outliers removed

<table>
<thead>
<tr>
<th>TREATMENT GROUP</th>
<th>MORB %</th>
<th>1ST RELAPSE %</th>
<th>RAIL %</th>
<th>MORT %</th>
<th>TX COST /HD PLACED</th>
<th># OF TX’S</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI &amp; NPIE</td>
<td>32</td>
<td>46</td>
<td>4.2</td>
<td>3.1</td>
<td>16.68</td>
<td>1.77</td>
</tr>
<tr>
<td>PIR &amp; NPIER</td>
<td>33</td>
<td>41</td>
<td>4.1</td>
<td>2.4</td>
<td>15.36</td>
<td>1.68</td>
</tr>
<tr>
<td>P - VALUE</td>
<td>.73</td>
<td>.03</td>
<td>.63</td>
<td>.09</td>
<td>.11</td>
<td>.07</td>
</tr>
</tbody>
</table>

P - VALUE: .73, .03, .63, .09, .11, .07
In-contact Pen Exposure Effect
(fence vs. water tank exposure)

- PI PENS
- NPIE PENS
- PIR PENS
- NPIER PENS
- NPIU PENS
- QUARANTINE PENS
## Fence vs Water Tank Exposure

Pens with no status change and outliers removed

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>PENS</th>
<th>WT Gain D IN</th>
<th>F/G D IN</th>
<th>ADG D IN</th>
<th>COG D IN</th>
<th>P - Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fence</td>
<td>5</td>
<td>99</td>
<td>7.18</td>
<td>1.49</td>
<td>0.951</td>
<td>0.53</td>
</tr>
<tr>
<td>Water Tank</td>
<td>7</td>
<td>89</td>
<td>7.55</td>
<td>1.42</td>
<td>1.097</td>
<td>0.38</td>
</tr>
<tr>
<td>P - Value</td>
<td>.53</td>
<td>.73</td>
<td>.66</td>
<td>.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Fence vs Water Tank Exposure

Pens with no status change and outliers removed

<table>
<thead>
<tr>
<th>TREATMENT GROUP</th>
<th>MORB %</th>
<th>BRD MORB %</th>
<th>1ST RELAPSE %</th>
<th>RAIL %</th>
<th>MORT %</th>
<th>BRD MORT %</th>
<th>TX COST /HD PLACED</th>
<th>AVG # OF TX’S</th>
</tr>
</thead>
<tbody>
<tr>
<td>FENCE</td>
<td>24.91</td>
<td>23.37</td>
<td>41.5</td>
<td>2.37</td>
<td>2.90</td>
<td>1.73</td>
<td>14.72</td>
<td>1.68</td>
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<td>WATER TANK</td>
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<td>32.45</td>
<td>48.3</td>
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<td>17.40</td>
<td>1.74</td>
</tr>
<tr>
<td>P - VALUE</td>
<td>.41</td>
<td>.32</td>
<td>.41</td>
<td>.51</td>
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<td>.62</td>
<td>.34</td>
<td>.70</td>
</tr>
</tbody>
</table>
Economic Analysis

- Based on purchase costs, production costs and mortality differences.

- **Trial 1**
  - Cost/head in PI pens
    - $47.43

- **Trial 2**
  - Cost/head in exposed population
    - $67.49
  - Cost/head in total population
    - $41.17
ADDED VALUE?