THE EFFECT OF HOOF TRIMMING

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BioBusiness “Cow group” partners

- **Sweden** (Business model)
- **Netherlands** (Video score)
- **Belgium** (Image Processing)
- **Israel** (Setup & Exp. Data collection)

Visit [www.bio-business.eu](http://www.bio-business.eu)
Last Year (2012) EAAP meeting

• The development of machine-vision based sensors:
  • Automatic Body Condition Scoring
  • Automatic Lameness Detection

This EAAP (2013) meeting

• Application of these sensors
Automatic Lameness detection

\[ \text{BMP} = w_1 \frac{\theta_2}{\theta_1} + w_2 \frac{\theta_4}{\theta_3} + w_3 \frac{L_1}{L_2} \]
3rd Setup: 3D-camera

Camera

Antena
Automatic detection: BCS and Lameness
Machine vision and human observation

22 days ➔ 1500+ recordings
Machine vision vs. human observation

Last EAAP Meeting

This EAAP Meeting
Animal Sensing (Israel)

- Commercial kibbutz dairy farm
  - 3x milking/day
- Sensor-based heat detection and nutrition management
  - HR™-tag (SCR Engineers Ltd., Netanya Israel)
Lameness definition

Deviation in gait and posture (locomotion) resulting from pain or discomfort from hoof or leg injuries and disease

1. Welfare
2. Prevalence [30%]
3. Causes
4. Economic [300 NIS]
Lameness treatments

- Foot bathing
- Foot washing
- Hoof trimming

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Routine hoof trimming

- Refet Ha’Emek, kibbutz Yif’at
  - Twice per year
    - Before summer: May
    - Before winter: November
  - Whole herd (~1100 cows) in 10 days
Hoof Trimming procedure
# Hoof disorders

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Single</th>
<th>+1 other</th>
<th>+2 other</th>
<th>+3 other</th>
<th># diagnosed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermatitis interdigitalis</td>
<td>40</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td>Digital dermatitis</td>
<td>93</td>
<td>22</td>
<td>10</td>
<td>0</td>
<td>125</td>
</tr>
<tr>
<td>Double sole</td>
<td>56</td>
<td>41</td>
<td>15</td>
<td>3</td>
<td>115</td>
</tr>
<tr>
<td>Sole ulcer</td>
<td>5</td>
<td>25</td>
<td>13</td>
<td>3</td>
<td>46</td>
</tr>
<tr>
<td>Panaritium</td>
<td>15</td>
<td>12</td>
<td>4</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Horn cavity</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Torn hoof edge</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Chronic laminitis</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>210</td>
<td>114</td>
<td>54</td>
<td>12</td>
<td>390</td>
</tr>
</tbody>
</table>
Herd: 1097 cows → 299 cows (27%) with hoof disorder

<table>
<thead>
<tr>
<th>Location</th>
<th>front</th>
<th>hind</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>44</td>
<td>237</td>
<td>18</td>
</tr>
<tr>
<td>%</td>
<td>15</td>
<td>79</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of legs</th>
<th>Not spec.</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1</td>
<td>217</td>
<td>74</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>%</td>
<td>0.3</td>
<td>72.6</td>
<td>24.8</td>
<td>1.3</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of diagnoses</th>
<th>Not spec.</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4+</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>11</td>
<td>206</td>
<td>61</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>%</td>
<td>3.7</td>
<td>68.9</td>
<td>204</td>
<td>5.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Herd locomotion score

Proportion of cows

Locomotion Score 2
Locomotion Score 1
Locomotion Score 3
Locomotion Score 4
Locomotion Score 5

Trimming Window

07/11 17/11 27/11 07/12 17/12 27/12 06/01 16/01 26/01 05/02 15/02
Trimming period locomotion scoring

- 19 live locomotion scoring sessions
  - 5 sessions
- Individual cows scored throughout all 5 sessions
  - 54 lame cows
  - 109 nonlame cows
- Missing individuals
  - Cow traffic
  - Group changes

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Lame cows

Trimming

The figure shows the proportion of lame cows over time relative to trimming. The x-axis represents time in days, with specific time points marked as 1.5, 8, 15, and 70 days. The y-axis represents the proportion of cows, ranging from 0 to 1.

At 1.5 days, the proportion of lame cows is marked at 0.5. At 8 days, it decreases to 0.4. At 15 days, it is at 0.3, and at 70 days, it is at 0.2. The chart shows a decrease in the proportion of lame cows over time.
Non-lame cows

Trimming

-2  1.5  8  15  70

Time relative to trimming [days]

Proportion of cows

109 109 109 109 109
Behaviour sensing

- **HR-Tag™**
  - Cow identification
  - Ruminating time \([\text{min}/2\text{h}]\)
  - Activity \([\text{activity index}/2\text{h}]\)
  - Heat detection

- **Free Flow™**
  - Milk yield

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## Neck activity response to trimming

<table>
<thead>
<tr>
<th>Variable</th>
<th>F-stat</th>
<th>df1</th>
<th>df2</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimming</td>
<td>4.821</td>
<td>1</td>
<td>527</td>
<td>0.029</td>
</tr>
<tr>
<td>Parity</td>
<td>6.664</td>
<td>3</td>
<td>527</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lesion</td>
<td>5.672</td>
<td>1</td>
<td>527</td>
<td>0.018</td>
</tr>
<tr>
<td>Milk</td>
<td>4.335</td>
<td>1</td>
<td>527</td>
<td>0.038</td>
</tr>
<tr>
<td>Locomotion Score</td>
<td>26.412</td>
<td>1</td>
<td>527</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milk*Trimming</td>
<td>6.368</td>
<td>1</td>
<td>527</td>
<td>0.012</td>
</tr>
</tbody>
</table>

Time relative to trimming [days]

 moons

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Rumination response to trimming

<table>
<thead>
<tr>
<th>Variable</th>
<th>F-stat</th>
<th>df1</th>
<th>df2</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimming</td>
<td>0.011</td>
<td>1</td>
<td>516</td>
<td>0.917</td>
</tr>
<tr>
<td>Trimming*Parity</td>
<td>7.049</td>
<td>3</td>
<td>516</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milk</td>
<td>41.966</td>
<td>1</td>
<td>516</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milk*Trimming</td>
<td>3.316</td>
<td>1</td>
<td>516</td>
<td>0.069</td>
</tr>
</tbody>
</table>

![Graph showing rumination time response to trimming]
Milk yield response to trimming

<table>
<thead>
<tr>
<th>Variable</th>
<th>F-stat</th>
<th>df1</th>
<th>df2</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimming</td>
<td>0.604</td>
<td>1</td>
<td>516</td>
<td>0.437</td>
</tr>
<tr>
<td>Parity</td>
<td>3.566</td>
<td>3</td>
<td>516</td>
<td>0.014</td>
</tr>
<tr>
<td>Lactation stage</td>
<td>37.156</td>
<td>3</td>
<td>516</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Parity*lactation stage</td>
<td>2.455</td>
<td>9</td>
<td>516</td>
<td>0.010</td>
</tr>
<tr>
<td>Lactation stage*trimming</td>
<td>4.183</td>
<td>3</td>
<td>516</td>
<td>0.006</td>
</tr>
<tr>
<td>Activity</td>
<td>4.985</td>
<td>1</td>
<td>516</td>
<td>0.026</td>
</tr>
<tr>
<td>Ruminating time</td>
<td>64.952</td>
<td>1</td>
<td>516</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Discussion

- No differentiation between lesions/disorders
- Day of trimming → cows out of routine
- Unknown onset of disorder
- Pre-winter hoof trimming → wet environment
- Preventive hoof trimming ≠ Treatment trimming
- Single farm data
Conclusion

- Most disorders in hind hoofs
- After two months, herd level not recovered
- Hoof trimming affects cow behaviour and performance
- Activity directly affected
- Effects ~ parity, lactation stage & lesion presence

More questions?

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Thank you!