IDENTIFYING MASTITIS EARLIER BY COMBINING TEST DAY DATA AND AMS SENSOR DATA

23 May 2024 | 47th ICAR Annual Conference | Bled | G. Flossmann\textsuperscript{1}, J. Duda\textsuperscript{1} and F. Grandl\textsuperscript{1,2}

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- Improvement of detection of potential mastitis cows in AMS herds
- Use a combination of AMS sensor data and performance recording data
- Provide different warning thresholds for improved herd management routines

⇒ Development of a model to estimate a daily cell count status for all lactating animals in the herd
Data description

**Data set**
- 113 farms / 9,859 cows
- 8,278 dual purpose Fleckvieh cows, 1,581 other breeds
- July 2020 to March 2022
- Test day records
- AMS sensor data
  - AMS somatic cell count (AMS SCC)
  - Electrical conductivity (EC)
- Training set: 93 farms / 8,244 cows
  Test set: 20 farms / 1,615 cows

**Data cleaning**
- At least 2 of 4 quarters with EC data
- EC > 48 “Lely units”\(^1\)
- Milk yield > 3 kg/d, lactose > 4 %
- Days in milk > 4
- Correlation of log(SCC) from test day and AMS > 0.95

**Validation data set**
- April to August 2022
- 155 farms / 11,493 cows

\(^1\) 100 „Lely units“ = 6 mS/cm \(\Rightarrow\) 70 = normal
Concept of modelling

**Aim**

- Develop a model combining daily AMS data and test day data to identify cows with
  - SCC ≥ 200,000 per ml
  - SCC ≥ 400,000 per ml

![Graph showing electrical conductivity and somatic cell count over days before mastitis diagnosis.](Image)

![Graph showing difference in quarter conductivity over days before mastitis diagnosis.](Image)
Aim

- Develop a model combining daily AMS data and test day data to identify cows with
  - SCC ≥ 200,000 per ml
  - SCC ≥ 400,000 per ml

Explanatory variables used

- AMS data
  - SCC
  - Difference in quarter conductivity (Ecdiff)
  - Daily milk yield
- Test day data (last test day before prediction)
  - SCC
  - Milk constituents
  - Days in milk
  - Breed
  - Lactation number
Generalised linear model

<table>
<thead>
<tr>
<th></th>
<th>200-model</th>
<th>400-model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
<td>0: SCC &lt; 200 — 1: SCC ≥ 200</td>
<td>0: SCC &lt; 400 — 1: SCC ≥ 400</td>
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<tr>
<td><strong>Explanatory variables</strong></td>
<td>SCC AMS; SCC test day; ECdiff; lactose-%; milk-kg; DIM</td>
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<tr>
<td><strong>Variables not used</strong></td>
<td>Lactation number; fat-%; protein-%; breed</td>
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<td><strong>Sensitivity</strong></td>
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<tr>
<td><strong>Specificity</strong></td>
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</tbody>
</table>

![ROC curve for 200-model](image1)

![ROC curve for 400-model](image2)
⇒ Model performs well on most farms
⇒ Model can be used for farms that were not in the training set
Classification of farms

Identifying mastitis earlier by combining test day data and AMS sensor data | 23 May 2024 | 47th ICAR Annual Conference | Bled | Florian Grandl

Model: share of cows exceeding SCC of 200,000 or 400,00 per farm

Test day results: share of cows exceeding SCC of 200,000 or 400,00 per farm

⇒ Mastitis problems can be detected
Weekly e-mail report for farms
Daily individual cow status combining both models
  - Status 0: predicted SCC status <200,000 cells/ml
  - Status 1: predicted SCC status ≥200,000 and <400,000 cells/ml
  - Status 2: predicted SCC status ≥400,000 cells/ml

<table>
<thead>
<tr>
<th>Stallnr.</th>
<th>Name</th>
<th>LOM</th>
<th>Zellzahl-Status am</th>
<th>Datum Beobachtung</th>
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</tbody>
</table>
- 200- and 400-models were also implemented without using AMS SCC data
- Model performance was still satisfying

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<td>0.83</td>
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⇒ SCC prediction is also available for farms without inline SCC measurement system
144 farms with at least 5 test days were analysed:
Correlation lab SCC - AMS SCC > 0.7
- on all test days: 19 farms
- on more than half of test days: 99 farms
- frequently fluctuating correlations: 26 farms

⇒ For farms with inline SCC measurement, congruence between AMS and lab SCC on test days determines which model is applied
⇒ Together with cow report, farms receive information about SCC correlation between AMS measurements and lab results
Classification for cell count thresholds works well
Classification is also possible for farms without inline cell count measurement
Model can be extended to new farms

What’s next:
• Collect feedback from pilot farms
• Implementation in herd management software for daily calculation and notification
• Extend model to other AMS brands/models (?)
Contact us!

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