An overview of wished recording requirements to satisfy to the current evolution of milk recording organizations and selection programs in France

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Aims of the presentation

- Present the context of Milk Recording in France and the requests for changes (flexibility, cost,...)

- Summarize 3 studies realised between 2003 & 2013 and show how it meets the needs of evolution to maintain a high level of quality

- Propose evolution of ICAR guidelines on milking schemes
Definition of 8 milking schemes in France

- **A**: supervised 24 hours milking
- **AT**: supervised alternative milking
- **B**: unsupervised 24 hours milking
- **BT**: unsupervised alternative milking
- **AR**: supervised 24 hours robotic milking
- **BR**: unsupervised 24 hours robotic milking
- **CZ**: supervised / unsupervised 24 hours (sampling one milking)
- **BZ**: unsupervised 24 hours with sampling one milking
## Evolution of the penetration rate, herd size, milking schemes in France

<table>
<thead>
<tr>
<th>Year</th>
<th>Penetration rate</th>
<th>Herd size</th>
<th>% of dairy herds recorded according to milking schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>2003</td>
<td>66 %</td>
<td>40.4</td>
<td>90.1 %</td>
</tr>
<tr>
<td>2005</td>
<td>68 %</td>
<td>41.5</td>
<td>85.5 %</td>
</tr>
<tr>
<td>2007</td>
<td>66 %</td>
<td>41.5</td>
<td>78.4 %</td>
</tr>
<tr>
<td>2009</td>
<td>68 %</td>
<td>46.1</td>
<td>73.2 %</td>
</tr>
<tr>
<td>2011</td>
<td>69 %</td>
<td>48.1</td>
<td>68.2 %</td>
</tr>
<tr>
<td>2013</td>
<td>69 %</td>
<td>52.1</td>
<td>65.6 %</td>
</tr>
</tbody>
</table>

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The environment is changing…

Evolution of the number of farms equipped with AMS in France

+ 300 to 400 AMS per year in France
Challenges and requests

- Maintain a high penetration rate
  - To ensure a selection base as wide as possible
  - To collect classical and new traits (fatty acids, …)

- Maintain a sufficient quality for genetic evaluation

- Develop new milking schemes
  - To reduce costs of milk recording
  - To limit the constraints of milk samples collection
  - To improve flexibility by different approaches (increase or decrease of recording intervals, length of sampling period…)

3 studies have been realised between 2003 and 2013
Datasets used (1)

**Dataset 1 : AT and CZ schemes from A1 method**
- Data were collected on one experimental farm
- Daily registration of morning / evening milk (+ sample collection one day per week) (13,574 TD on 290 cows with a milking interval of 10/14 hours)
  - Cows were registered during a long period (complete lactation)

**Dataset 2 : AT and CZ schemes with and without adjustments from A4/A5 methods**
- Data were collected on 286 commercial farms with lactocorder
- Morning / evening sampling analysed separately (89,828 TD on 18,101 cows)
  - Individual milking times
Datasets used (2) and average performance

- Dataset 3: Reduce the sampling period to 12 hours on robotic scheme
  - Data were collected on 268 commercial farms with AMS
  - 52 361 TD from 19 783 cows
  - With all samples collected on 12 hours sampling period

Average yield performance

<table>
<thead>
<tr>
<th>Specificity</th>
<th>Dataset 1</th>
<th>Dataset 2</th>
<th>Dataset 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Milk (kg)</td>
<td>20.1</td>
<td>27.9</td>
<td>26.9</td>
</tr>
<tr>
<td>Mean Fat (kg)</td>
<td>0.850</td>
<td>1.116</td>
<td>1.084</td>
</tr>
<tr>
<td>Mean Protein (kg)</td>
<td>0.659</td>
<td>0.901</td>
<td>0.873</td>
</tr>
</tbody>
</table>
Methods used for adjustment on dataset 2

Dataset 2 : AT and CZ schemes with adjustments

For AT model:
• used the adjustments estimated as proposed by Liu and al (2000) for milk, fat and protein (yield)
• considering separate regressions for every combination of parity $i$, milking interval $j$, lactation stage $k$:
  \[ y_{AT\text{adjust.}}[ijk] = b_0[ijk] + b_1[ijk] y_{AT}[ijk] \]

For CZ model:
• extension of the AT adjustments for fat and protein (yield) by including the other milking of a test-day as covariate for
  \[ y_{\text{Adjust}}[ijk] = y_{\text{AT - am}}[ijk] + b_2[ijk] \text{Milk\text{-pm}}[ijk] \]
  \[ y_{\text{Adjust}}[ijk] = y_{\text{AT - pm}}[ijk] + b_2[ijk] \text{Milk\text{-am}}[ijk] \]

On both case:
  2 parity (first vs 2nd and later)
  5 milking interval (of 30 minutes)
  12 lactation stage (of 30 days)
Results: Impact of proposed milking schemes on the daily yield
## Correlation ($R^2$) between a reference and estimated daily yields

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Dataset</th>
<th>Adjust.</th>
<th>Milk</th>
<th>Fat</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>AM</td>
<td>PM</td>
<td>AM</td>
</tr>
<tr>
<td>AT</td>
<td>1</td>
<td>No</td>
<td>0.955</td>
<td>0.908</td>
<td>0.802</td>
</tr>
<tr>
<td>AT</td>
<td>2</td>
<td>No</td>
<td>0.939</td>
<td>0.914</td>
<td>0.865</td>
</tr>
<tr>
<td>AT</td>
<td>2</td>
<td>Yes</td>
<td>0.959</td>
<td>0.940</td>
<td>0.894</td>
</tr>
<tr>
<td>CZ</td>
<td>1</td>
<td>No</td>
<td></td>
<td></td>
<td>0.856</td>
</tr>
<tr>
<td>CZ</td>
<td>2</td>
<td>No</td>
<td></td>
<td></td>
<td>0.903</td>
</tr>
<tr>
<td>CZ</td>
<td>2</td>
<td>Yes</td>
<td></td>
<td></td>
<td>0.931</td>
</tr>
<tr>
<td>R</td>
<td>3</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary of results on the daily yield

- CZ scheme increases accuracies vs AT
  - on milk, fat and protein yields in comparison with AT schemes
  - milk is 1.00 by construction and protein is over than 0.99

- Adjusted scheme increases accuracies
  For AT scheme:
  - on milk, fat and protein yields
  - but the accuracy remains lower than 0.90 for fat yield

  For CZ scheme:
  - on fat yield (accuracy is greater than 0.91 for fat yield)

- With robot milking, the accuracy level is acceptable
  - higher than 0.96 for fat yield
  - higher than 0.99 for protein yield
Results: Impact of proposed milking schemes on the lactation yield
Number of milk recording necessary to reach $R^2$ of 0.95 and 0.98 between a tested milking scheme and A4 reference one

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Dataset</th>
<th>1st recording</th>
<th>Milk $R^2$</th>
<th>Fat $R^2$</th>
<th>Protein $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.95 0.98</td>
<td>0.95 0.98</td>
<td>0.95 0.98</td>
</tr>
<tr>
<td>AT</td>
<td>1</td>
<td>AM</td>
<td>2 4</td>
<td>7 Never</td>
<td>2 5</td>
</tr>
<tr>
<td>AT</td>
<td>1</td>
<td>PM</td>
<td>2 4</td>
<td>5 Never</td>
<td>3 6</td>
</tr>
<tr>
<td>CZ</td>
<td>1</td>
<td>AM</td>
<td></td>
<td>3 7</td>
<td>1 1</td>
</tr>
<tr>
<td>CZ</td>
<td>1</td>
<td>PM</td>
<td></td>
<td>2 6</td>
<td>1 1</td>
</tr>
</tbody>
</table>
Summary of results on the lactation yield estimation

With AT scheme:
- high level of correlation (0.98) are reached quickly for milk yield
- for protein yield, the situation is worse than milk yield
- for fat yield, 5 or 7 test-day are needed to reach $R^2$ of 0.95

With CZ scheme:
- for protein yield, the first recording is sufficient to reach $R^2$ of 0.98
- for fat yield, 2 or 3 monthly test-day are needed to reach $R^2$ of 0.95, 6 or 7 test-day for 0.98.

The comparison of AT and CZ shows a clear advantage of recording milk yield on 24 hours to improved the estimation of fat and protein yields
Conclusion

These French studies show that:
- CZ scheme is an alternative between A scheme and AT scheme
- Adjustment in AT and CZ schemes improve the accuracy
- Robot scheme is less accurate than A scheme for fat yields

The schemes developed since the last 10 years allowed:
- to maintain a high rate penetration of milk recording
- to reduce the cost of milk recording
- the progression of "low demanding" schemes

There are alternative solutions to A scheme. Alternate schemes with adjustments (AT, CZ) are interesting ways that meet the needs of farmers, technical support and genetic evaluation.
Thank you for your attention