Once-daily milking ability of the Lacaune ewes: synthesis of the results of a 4 years French study


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64th EAAP, 27th August 2013, Nantes, France
AIM

- To study once-daily milking ability of the dairy Lacaune ewes. French breeder demand to reduce milking labor.

- To produce available parameters for modelling at the farm level and dairy plant level breeding systems using once-daily milking during all or a part of the milking period.

- To describe/analyse anatomo and physiological criteria related to the once-daily milking ability of the Lacaune ewes.
DESIGN applied for lactation management

**Lambing**

- Suckling (plus ODM)

**Weaning**

- Milking only

**Drying-off**

- TDM (twice daily milked)
- ODM (once daily milked)
- Ewes either in TDM or ODM from 50 DIM until drying-off
- TDM for all the ewes during 2 weeks

Ewes either in TDM or ODM from 50 DIM until drying-off
Analysis of the milk production data

- milk traits considered only from starting of the once daily milking period, i.e. from 50 DIM to the end of the lactation

- comparison of ODM and TDM ewes results within each experiment (8 in flock 1 and 2 in flock 2), and between experiments (meta-analysis)

- individual approach (variability):
  - reference: individual MILK in TDM situation between 30 and 50 DIM
  - individual milk loss (after 50 DIM) / individual reference
Flock 1: Lactation curves of multiparous ODM or TDM ewes

- Individual milk reference in TDM initial period
- Immediate milk loss after a week of ODM
- Global milk loss for the whole ODM period

Starting of the ODM period at 50 DIM

ODM period:
- ODM
- TDM ewes
DESIGN: 574 lactations / 10 trials / 2 flocks

<table>
<thead>
<tr>
<th>YEAR</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FLOCK 1</strong> (La Fage)</td>
<td>24 TDM</td>
<td>24 TDM</td>
<td>24 TDM</td>
<td>24 TDM</td>
<td>PRIMIPAROUS</td>
</tr>
<tr>
<td></td>
<td>24 ODM</td>
<td>24 ODM</td>
<td>24 ODM</td>
<td>24 ODM</td>
<td></td>
</tr>
<tr>
<td><strong>FLOCK 1</strong> (La Fage)</td>
<td>24 TDM</td>
<td>24 TDM</td>
<td>24 TDM</td>
<td>24 TDM</td>
<td>MULTIPAROUS</td>
</tr>
<tr>
<td></td>
<td>24 ODM</td>
<td>24 ODM</td>
<td>24 ODM</td>
<td>24 ODM</td>
<td></td>
</tr>
<tr>
<td><strong>FLOCK 2</strong> (La Cazotte)</td>
<td>25 TDM</td>
<td>25 TDM</td>
<td>25 TDM</td>
<td>25 TDM</td>
<td>MULTIPAROUS</td>
</tr>
<tr>
<td></td>
<td>25 ODM</td>
<td>25 ODM</td>
<td>25 ODM</td>
<td>25 ODM</td>
<td></td>
</tr>
</tbody>
</table>
Primiparous and Multiparous Lacaune Dairy Ewes Daily Milked Twice or Once (morning)

Dry matter intake (DMI) measured individually (indv) or in group (grp)
Dry matter intake (DMI) measured individually (indv) or in group (grp)

Two flocks and two feeding systems

**LA CAZOTTE (2 years)**

**Mixed forages** *ad libitum >15% refusal*

+ 

**Concentrates** (variable amount)

adjusted or not to the actual milk yield level of the batch

Year 1: 0.9 – 1.2 kg/d/ewe
Year 2: 0.7 – 1.2 kg/d/ewe

**LA FAGE (4 years)**

**Total mixed ration - TMR**

*ad libitum >10% ref.*  
(on DM basis)

Gramineous silage  (35-65%)
Gramineous/Lucerne hay (13-38%)
Concentrates  (19-32%)
Flock 2: planned feeding design of multiparous ewes

**LA CAZOTTE**  **MULTIPAROUS**  (4 groups of 25 ewes)

Two: ewes milked twice per day  
One: ewes milked once per day

**YEAR 1 and YEAR 2**  
Two_100: objective requirements 100%  
(based on expected initial milk yield of 3.5 l/d)  
One_100: same diet as Two_100

**YEAR 1**  
One_92: objective requirements: 92%  
One_85: objective requirements: 85%

**YEAR 2**  
One_75: objective requirements: 75%  
One_75c: same diet as One_75 but concentrates adjusted monthly to the milk yield

After 100 – 120 DIM amount of concentrates were adjusted to the milk yield for all groups.
**Flock 2 : realized feeding design of multiparous ewes**

**LA CAZOTTE**  **MULTIPAROUS**

Average daily DMI (kg) of *forages* and *concentrates* during 105 days experiment

<table>
<thead>
<tr>
<th></th>
<th>YEAR 1</th>
<th>YEAR 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forages</td>
<td>Concentrates</td>
</tr>
<tr>
<td>Two_100</td>
<td>2.26&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.28</td>
</tr>
<tr>
<td>One_100</td>
<td>2.06&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.18</td>
</tr>
<tr>
<td>One_92</td>
<td>2.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.14</td>
</tr>
<tr>
<td>One_85</td>
<td>2.07&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.97</td>
</tr>
<tr>
<td>One_75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One_75c</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RESULTS

- Flock 1: MILK traits, udder health and milking speed

- Flock 2: MILK traits and udder health

- Flocks 1 and 2: Dry matter intake, body weight and body condition score, and metabolic results

- Flock 1: individual MILK production approach and physiological results
Meta-analysis of primiparous ewes in Flock 1 (La Fage) : LSM estimates for different traits (when significant)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Number of milking per day (at milking period only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TDM</td>
</tr>
<tr>
<td>Milking length</td>
<td></td>
</tr>
<tr>
<td>MILK (litres)</td>
<td>182</td>
</tr>
<tr>
<td>Fat content (g/l)</td>
<td>71,6</td>
</tr>
<tr>
<td>Protein content (g/l)</td>
<td>54,0</td>
</tr>
<tr>
<td>SCC (log2)</td>
<td></td>
</tr>
<tr>
<td>Latency time (s)</td>
<td>26,1</td>
</tr>
</tbody>
</table>
Meta-analysis of multiparous ewes in Flock 1 (La Fage): LSM estimates for different traits (when significant)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Number of milking per day (at milking period only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TDM</td>
</tr>
<tr>
<td>Milking length</td>
<td></td>
</tr>
<tr>
<td>MILK (litres)</td>
<td>283</td>
</tr>
<tr>
<td>Fat content (g/l)</td>
<td></td>
</tr>
<tr>
<td>Protein content (g/l)</td>
<td>56,2</td>
</tr>
<tr>
<td>SCC (log2)</td>
<td></td>
</tr>
<tr>
<td>Latency time (s)</td>
<td>26,18</td>
</tr>
</tbody>
</table>
MILK YIELD (Flock 1): difference TDM – ODM (%)

Primiparous  Flock 1 La Fage  Multiparous

meta-analysis
- 14 %

meta-analysis
- 15 %
RESULTS

- Flock 1: MILK traits, udder health and milking speed

- Flock 2: MILK traits and udder health

- Flocks 1 and 2: Dry matter intake, body weight and body condition score, and metabolic results

- Flock 1: individual MILK production approach and physiological results
### Multiparous ewes in Flock 2 (La Cazotte) Year 2011: LSM estimates for different traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Two_100</td>
</tr>
<tr>
<td>Milking length</td>
<td>193</td>
</tr>
<tr>
<td>MILK YIELD</td>
<td>372 (a)</td>
</tr>
<tr>
<td></td>
<td>- 23 %</td>
</tr>
<tr>
<td>Fat content (g/l)</td>
<td>75,1 (a)</td>
</tr>
<tr>
<td>Protein content (g/l)</td>
<td>57,5</td>
</tr>
<tr>
<td>SCC (log2)</td>
<td>3,16</td>
</tr>
</tbody>
</table>
## Multiparous ewes in Flock 2 (La Cazotte) Year 2012: LSM estimates for different traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>LOT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Two_100</td>
</tr>
<tr>
<td>Milking length</td>
<td>198</td>
</tr>
<tr>
<td>MILK YIELD</td>
<td>387 (a)</td>
</tr>
<tr>
<td></td>
<td>- 16 %</td>
</tr>
<tr>
<td>Fat content (g/l)</td>
<td>73,3</td>
</tr>
<tr>
<td>Protein content (g/l)</td>
<td>57,9</td>
</tr>
<tr>
<td>SCC (log2)</td>
<td>2,91</td>
</tr>
</tbody>
</table>
MILK YIELD (Flock 2) : difference TDM – ODM (%)
### Summary of the ODM milk trait results in Flocks 1 and 2 compared to TDM traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>Difference</th>
<th>TDM – ODM %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>La Fage primiparous</td>
<td>La Fage adults</td>
</tr>
<tr>
<td>Milking length</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MILK yield (l)</td>
<td>-14 %</td>
<td>-15 %</td>
</tr>
<tr>
<td>Fat content (g/l)</td>
<td>-2.7 %</td>
<td>NS</td>
</tr>
<tr>
<td>Protein content. (g/l)</td>
<td>+4.6 %</td>
<td>+2 %</td>
</tr>
<tr>
<td>SCC (log2)</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Latency time (s)</td>
<td>-9 %</td>
<td>-13 %</td>
</tr>
</tbody>
</table>

|                        | ad libitum feeding | Adjusted feeding |

Legend:
- NS: Not significant
RESULTS

- Flock 1: MILK traits, udder health and milking speed
- Flock 2: MILK traits and udder health
- Flocks 1 and 2: Dry matter intake, body weight and body condition score, and metabolic results
- Flock 1: individual MILK production approach and physiological results
Flocks 1 and 2: **Dry matter intake (DMI)** measured in group (flock 2 and half experiments in flock 1) or individually (half experiments in flock 2)

Flocks 1 and 2: **body weight (BW) and body condition score (BCS)**

Flock 1: individual blood sampling (biweekly in 2010) for analyses of plasma:
- metabolites: NEFA, Triglycerides, Glucose
- hormones: insulin, leptin, tri-iodothyroidienne (T3)
Flock 2 and year 2012: Dry matter intake (DMI) of multiparous ODM or TDM Lacaune ewes

Average forages dry matter intake (DMI) of ewes milked twice (Two) or once (One) and fed in group (year 2)

Starting once milking

Concentrate adjusted

day in milk (d)

weaning

0 14 28 42 56 70 84 98 112 126 140 154

DMI (kg)

0 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6

One_75c
One_75
Two_100
One_100
Flock 1 and 4 years: Dry matter intake (DMI) of multiparous ODM or TDM Lacaune ewes

Average total mixed ration dry matter intake (DMI) of ewes milked twice (Two) or once (One) and fed individually (indiv) or in group (grp)

![Graph showing dry matter intake (DMI) for two groups over four years.](image-url)
Flock 1 and 4 years: Dry matter intake (DMI) of primiparous ODM or TDM Lacaune ewes

**LA FAGE**  **PRIMIPAROUS**

Average **total mixed ration** dry matter intake (DMI) of ewes milked twice (Two) or once (One) and fed individually (indiv) or in group (grp)

![Graph showing dry matter intake (DMI) for primiparous Lacaune ewes milked twice or once, fed individually or in group, from 2010 to 2013. The graph indicates no significant difference (NS) in DMI between the two milking frequencies and feeding methods across the years.]
Body weight (BW) and body condition score (BCS)
Flock 2: Body weight change (DWG) and body condition score (BCS)

Body weight change (DWG) depending on amount of concentrate

Body condition score (BCS)

Values with different letter within a year are significantly different (P<0.05)
Flock 1 and primiparous: Body weight change (DWG) and body condition score (BCS)

No significant effect on BW, DWG or BCS for ODM ewes during indoor feeding.
Flock 1 and multiparous: Body weight change (DWG) and body condition score (BCS)

Body weight gain (DWG):
Higher gain for ODM ewes during indoor feeding

Body condition score (BCS)
Year 2010

NO SIGNIFICANT EFFECT
Flock 1 and year 2010: insulin

**Evidence of a difference in body reserves mobilization:**

*as illustrated by a lower [INS] in ewes milked twice, irrespective of parity*
RESULTS

- Flock 1: MILK traits, udder health and milking speed
- Flock 2: MILK traits and udder health
- Flocks 1 and 2: Dry matter intake, body weight and body condition score, and metabolic results
- Flock 1: individual MILK production approach and physiological results
DESIGN for lactation management

Lambing

- Suckling (plus ODM)

Weaning

- Milking only

Drying-off

- TDM (twice daily milked)
  - or
  - ODM (once daily milked)

TDM for all the ewes during 2 weeks

Ewes either in

From 50 DIM until drying-off
Flock 1: Lactation curves of multiparous ODM or TDM ewes

- Individual milk reference in TDM initial period
- Immediate milk loss after a week of ODM
- Global milk loss for the whole ODM period

Starting of the ODM period at 50 DIM
MEASUREMENTS / DATA

- Lactation curves:
  - individual milk loss after the 2 first weeks of ODM period
  - individual milk loss during the whole period of ODM

- Physiological measurements
  - cisternal area by ultrasonography
  - cisternal and alveolar milk by atosiban method
  - tight junction permeability (lactose and Na+, K+ leak)
  - cortisol (animal welfare)
Flock 1: mammary ultrasonography

- Roquefort’in project
Phenotypic correlations between milk and milk loss at the ODM period

<table>
<thead>
<tr>
<th>Trait</th>
<th>MILK</th>
<th>2 first weeks LOSS</th>
<th>Total milk LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILK at the whole ODM period</td>
<td>1</td>
<td>0.40</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.23</td>
<td>0.18</td>
</tr>
<tr>
<td>2 first weeks MILK LOSS (%)</td>
<td>1</td>
<td>0.69</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Total MILK LOSS (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

*In red PRIMIPAROUS and blue MULTIPAROUS EWES*
Physiological results

See you in Paris, on 4-5 December 2013: 20th Journées 3R
CONCLUSION : main results (1/2)

- MILK decrease due to ODM around 15% and comparable for primiparous and multiparous ewes

- Milking speed higher for ODM ewes

- Udder health (SCC) of ODM ewes comparable to this of TDM ewes

- Without feeding restriction ODM ewes do not adjust their (forage or mixed ration) feed intake due their milk yield decrease.
CONCLUSION : main results (2/2)

- Compared to TDM ewes, milk protein content of ODM ewes tends to increase slightly, mainly due to soluble proteins increase.

- Overfeeding, which may be responsible for a milk fat content decrease, must be avoided as much as feeding adjustment to the actual milk of ODM ewes does not lead to a greater reduction in milk yield.

- May be body condition score is not a sufficient accurate measurement to show, as with metabolite results, that opportunities exist to economize feeding with body reserves.
CONCLUSION : ODM perspectives

- Pluridisciplinary research in progress: year 2013 to be included in meta-analysis

- Phenotypic results...genetic analysis to be performed

- Perspectives: milk composition and cheese

- Perspectives: many topics regarding nutrition and feeding

- Good ODM ability of the Lacaune breed...to be improved?
Fundings of Roquefort’in project:

Fond Unique Interministériel (FUI)
Midi-Pyrénées region
FEDER from EU
Aveyron and Tarn départements
Rodez town