New Technologies and Milk Recording

- Developments in smart farming
- Use of technology on dairy farms
- Milk Recording and ICAR
- ICAR Guide Lines Update
Developments in the past decades (1950-2010)
Smart farming? Individual approach in large herd...

- In heat?
- Feed intake ok?
- Enough milk?
- Mastitis?
- Lameness?
Information as a key element

From Measurement to Knowledge

Information on:

- Herd management
  - Milk recording, data services
- Farm and financial Management
- Support for governance, administration but also certification systems (quality assurance)
“We are drowning in data but starving for information”  John Naisbett
From Data to Result

- **DATA**
- **INFORMATION**
- **KNOWLEDGE**
- **ACTION**
- **RESULT**

- **OBJECTIVES**
- **Decision/Execution**
- **Analysis**
- **Integration**
- **Collection**

- **Benefit**
- **Cost**

- **Livestock Research Wageningen UR**
- **ICAR**
Smart dairy farming

Technological developments

Cow management

INTERACTION
TODAY

Observeren
Veehouder
Interpreten
Monagen

Agrosystems

TOMORROW?

WWW

Technologie
Model & Data

Kennis van dier & gedrag

PLF Concept

Knowledge systems

PLF-TOOLBOX
Smart farming, the answer?

- Technology to save labour and costs
- Technology to improve
  - Management
  - Milking including milk recording
  - Feeding
  - Social life
- Past many technologies, few were really successful, what can we learn from past?
New Technologies and Milk Recording

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Current technology on dairy farms

- Utilization of electronic devices and systems
  - ID, feeding concentrate, yield sensors, pedometers, conductivity
- Automatic Milking Systems growing fast
- More integrated systems on farm
  - (ID, Yield, Data collection, sampling)
- Need for extra information
- In-line sensors and on-farm analysers entering market
Sensor technology
Milk components
### Progesteron, LDH, BHB

<table>
<thead>
<tr>
<th>Focus area</th>
<th>Parameter analysed in milk</th>
<th>Early / on time detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproduction</td>
<td>Progesterone</td>
<td>Heat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silent heat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pregnancy</td>
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<tr>
<td></td>
<td></td>
<td>Abortion</td>
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<td></td>
<td></td>
<td>Cysts</td>
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<tr>
<td></td>
<td></td>
<td>Anoestrus</td>
</tr>
<tr>
<td>Udder health</td>
<td>LDH – lactate dehydrogenase</td>
<td>Mastitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subclinical mastitis</td>
</tr>
<tr>
<td>Feeding and</td>
<td>Urea</td>
<td>Feed ration – protein</td>
</tr>
<tr>
<td>energy balance</td>
<td>BHB – beta hydroxybutyrate</td>
<td>Ketosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subclinical ketosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Secondary metabolic disorders</td>
</tr>
</tbody>
</table>

**Reproduction status – progesterone profile chart**

- **Heat**
- **Heat/haemorrhage**

**Legend**:
- **heat cycle**
- **luteal cyst**
- **follicle cyst**
- **pregnancy**
Milk composition in-line

Dynamics of SCC – Lab Results

Dynamics of fat and yield fluctuations in AfFarm™ software

afimilk™ www.afimilk.com
Drivers for sensor introduction

- Need for management by exception
- Strong focus on milk recording elements
- Development of Food Chain programs
  - ICT and communication
  - Product demands
- Introduction of highly automated milking systems
- External analysis or on farm analysis
- Time gain, quality of data versus costs
- Introduction of new statistical methods
What to expect in future?

- New sensors?
  - Food safety, composition, health and welfare status
- On farm processing of milk
  - Differentiation, use of colostrum, milk refinery,
    - Less transport volume: UF, RO and other techniques
- Measure locally, (data) analysis externally?
- Function within the Food Supply Chain?
- From grass to milk?
- New milk recording services
- Role of ICAR?
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ICAR Milk Recording

- Genetic improvement
- Benefits not only from genetic improvement, also
  - Feeding
  - Disease control
  - Daily herd management
- ICAR focus strongly on milk meter accuracy levels
  - Approval procedures, device requirements and routine test procedures
- More towards integrated systems
  - New devices, test procedures, continuous monitoring
Animal production future challenges

- **Need:**
  - Improvement of production and product quality
  - Lowering cost price

- **Tools:**
  - Early warning systems for management and quality programs
  - Internet applications

- **Possibilities:**
  - Measurements at animal level
  - Day to day management – genetic data

- **Key success factors**
  - Robust and profitable systems, fitting in the management of the farmer
Modern dairy herds

- Cow ID, electronic milk meters, computer systems, Internet Access
- Need for information on SCC, urea, fat, protein, lactose, progesterone,
- Day to day management
- In-line and on-farm sensor developments
- External analysis samples in well organized laboratories
- Time gain, quality of data versus costs
### MPR and utilization of milk recording (2008)

<table>
<thead>
<tr>
<th></th>
<th>CAN West</th>
<th>DK</th>
<th>FR</th>
<th>DE</th>
<th>NL</th>
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<tbody>
<tr>
<td>Farms</td>
<td>6418</td>
<td>4750</td>
<td>98000</td>
<td>103500</td>
<td>21173</td>
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<tr>
<td>% MPR</td>
<td>71.2</td>
<td>92.6</td>
<td>61.2</td>
<td>66.5</td>
<td>80.6</td>
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<tr>
<td>% EMM</td>
<td>11.3</td>
<td>17.9</td>
<td>1.8</td>
<td>6.5</td>
<td>24.7</td>
</tr>
<tr>
<td>% Cows in MPR</td>
<td>81.6</td>
<td>95.7</td>
<td>70.3</td>
<td>83.8</td>
<td>85.1</td>
</tr>
</tbody>
</table>
Alternative routine testing methods

- Use of smart statistical methods
- Use of milk meter data (milk meter, yield, cow number)
- Difference average per cluster number vs average all milkings on all clusters
- Deviation $\mu_{ms} \approx \mu_{ms} \times \text{AvgKgMilk}_{Mm}$
- $\mu_{ms} = 0$ when meter operates ok
- Applied in several countries
New Technologies and Milk Recording

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ICAR Guide Lines milk analysers

- Laboratory equipment
  - Milk analyzers

- On-farm (at-line) analyzers
  - Milk analyzer on farm using a representative sample

- In-line analyzers
  - Mounted in the milking system
  - Real-time or at the end of milking on a representative sample of the whole milking

- Chapter 11 adapted for in-line analyzers
  - Similar approach as for milk meters
  - Compulsory and non-compulsory elements
  - Limits of error are different
  - Test day approach
Milk Analyzer Limits (adapted from Olivier – 2008/2010)

Principle of establishing limits

- Accuracy must respond to the need of the milk producer for daily management to detect/measure significant production changes
- That means dealing with normal day to day variation
- Proposal limits for on farm devices
  (introduction equivalence factor FE)
  - Lab analyzers: $FE = 1$
  - On-farm analyzers: $FE = 2$
  - On-farm in-line $FE = 2.5$
## Limits of error (Based on work by WP OMA (Olivier et al, 2010))

Table 11.2b. The accuracy limits for in-line milk analyzers in milk recording for fat and protein (compulsory elements for approval of milk analyzers)

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>range</th>
<th>standard deviation</th>
<th>bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>2.0-6.0 g/100g</td>
<td>0.25 g/100g</td>
<td>0.13 g/100g</td>
</tr>
<tr>
<td></td>
<td>5.0-14.0 g/100g</td>
<td>0.25 g/100g</td>
<td>0.25 g/100g</td>
</tr>
<tr>
<td>Protein</td>
<td>2.5-4.5 g/100g</td>
<td>0.25 g/100g</td>
<td>0.13 g/100g</td>
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<tr>
<td></td>
<td>4.0-./0 g/100g</td>
<td>0.25 g/100g</td>
<td>0.25 g/100g</td>
</tr>
</tbody>
</table>

Table 11.2c. The accuracy limits for in-line milk analyzers in milk recording for lactose, urea and SCC (non-compulsory elements for approval of milk analyzers)

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>range</th>
<th>standard deviation</th>
<th>bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactose</td>
<td>4.0-5.5 g/100g</td>
<td>0.25 g/100g</td>
<td>0.13 g/100g</td>
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<tr>
<td>Urea</td>
<td>10 – 7- mg/100g</td>
<td>15.0 mg/100 g</td>
<td>3.0 mg/100 g</td>
</tr>
<tr>
<td>SCC</td>
<td>0-2000</td>
<td>25 %</td>
<td>13 %</td>
</tr>
</tbody>
</table>
Take Home Message

- Milk Recording scenery is changing
- Smart Farming / use of sensor technology
- Introduction on-farm / in-line milk analyzers
- Will affect milk recording services
- Not only threat, also opportunities for new services
Thanks for your attention