# ICAR AND SENSOR DEVICES – A PROGRESS REPORT ON THE DEVELOPMENT OF ICAR GUIDELINES FOR CERTIFICATION, ROUTINE MAINTENANCE/CALIBRATION AND DATA USABILITY STANDARDS FOR SENSOR DEVICES FOR LIVESTOCK

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# in Modern Herd Recording

Are We Listening?

Livestock are ideal candidates for repeated measures – What can I tell you?

Producers are saying I made the investment - How are you going to use my farm/herd data?

Recording organizations are looking for guidance – What do we do?





### **ICAR** Sensor Devices Task Force





Kees de Koning, Netherlands

Uffe Lauritsen, Denmark

Franz Josef Auer, Austria



Reinhard Reents, Germany

Clement Allain, France

Brian Wickham, Ireland/NZ

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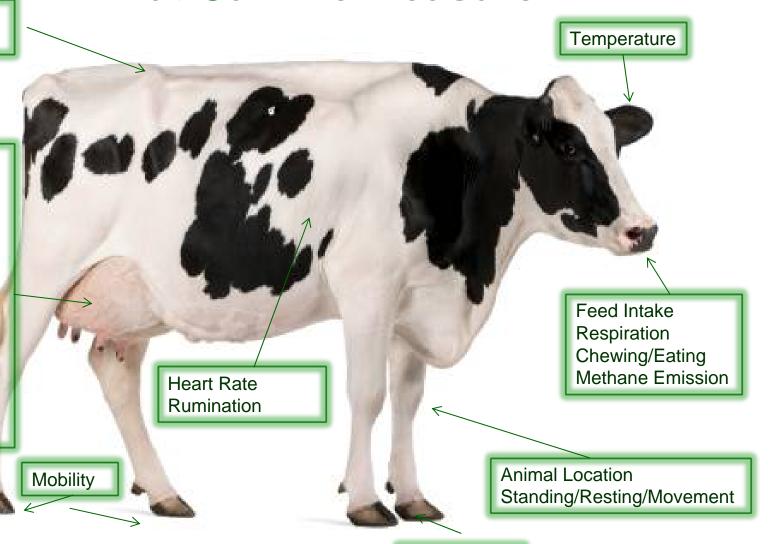




#### What Can We Measure?

Body Condition Body Weight

Milk Yield
Milk Composition
Milking Speed
Milk Flow Rate
Estrus/Pregnancy
Mastitis
Pathogens
MUN
Ketosis
VFAs
Johne's
BVD
BLV







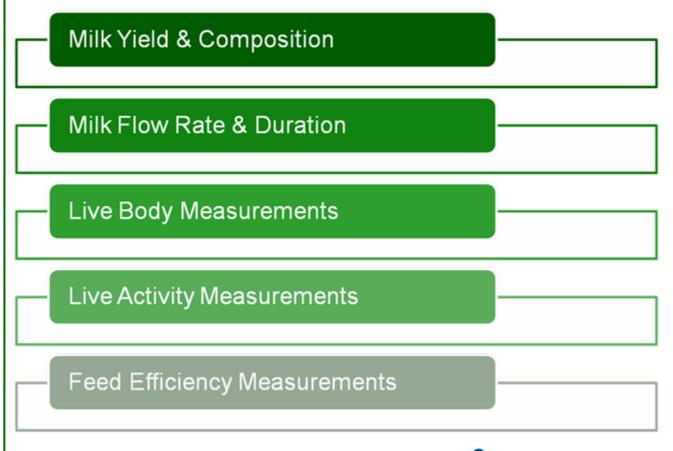


## Survey Says...

## Priorities for ICAR SD-TF

#### **Survey of ICAR Members & Experts**

- Survey summary & results to posted on ICAR website
- Strong support of ICAR guidelines for many meaures
- SD-TF grouped into five main categories







## Multiple Ways to Classify Sensor Data

#### Management Data

- Yield
- · scc
- Milking Speed
- Feed Efficiency

#### Animal Health Data

- Locomotion
- Reproduction
- Disease
- BCS/Weight

#### Animal Welfare Data

- Activity
- Mobility
- · Eating, Resting
- Heat Stress

Data for Genetic Evaluations

## Different Needs for Accuracy & Precision

#### Data Linked to Direct Farm Payments

- Yield
- Fat, Protein
- · SCC

#### **Alarm Data**

- Heat Detection
- SCC
- Locomotion
- Location

#### Yes/No Data

- Pregnancy
- Disease

#### **Trend Data**

- · BCS/Weight
- Milk Flow/Speed
- · Feed Efficiency
- · Eating, Resting





#### Reviewing Sensor Devices

What does the sensor measure?

What is the accuracy and precision of the measurement?

We cannot determine suitability of data until we know and understand the measurement

How is the device calibrated and maintained?





## What are We Measuring?

Mastitis
or
Milk Quality
or
Something
Else?

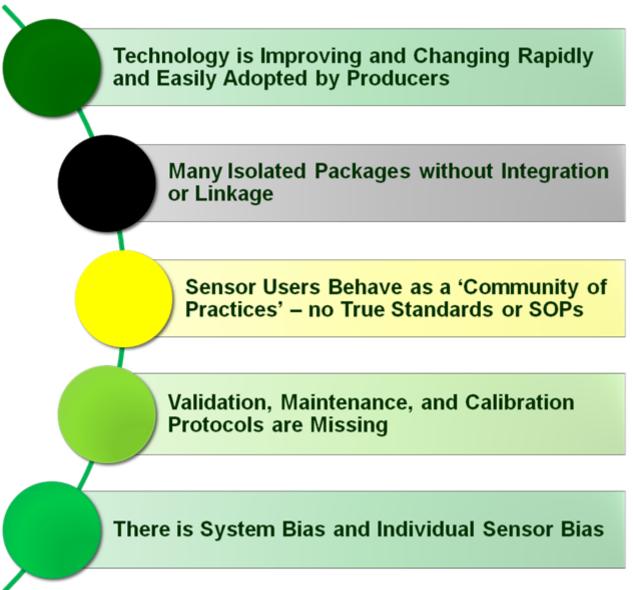
### Summary of Validation Criteria or Reference Measurements

- Review of milk quality measures by SD-TF
- Will be expanded to include measures from other categories
- Serve as validation for sensor devices
- Limited to device bias only, not system bias
- Will be published on ICAR website
- Paper to be presented in session on sensor devices on Sunday morning





# Current State of Sensor Technolog y





#### Needs of the Industry & Producer

Approval,
Calibration
& Best Use
Protocols

Sensor Approval and Validation

- Development of ICAR guidelines for sensors
- Testing & validation protocols
- Co-innovation & cooperation with manufacturers

Routine
Procedures
& Best
Practices

- Installation protocols
- Routine calibration and monitoring procedures
- Development of best practices for recording organizations





#### **Data Considerations for SD-TF**

#### Precision of Recording

4.2% vs. 4.22% vs. 4.222% (Milkfat) 181,000 vs 180,862 (SCC)

Values provided are the result of algorithm

#### Adjusting vs. Calibrating

Adjusting to known value (i.e. BT SCC) is not the same as calibrating the device(s)

Adjustments make the data look better but don't increase accuracy – the individual device biases still exist in the system

#### Challenges Exist with Sensor Systems

#### <u>Devices that Measure Multiple Parameters</u>

How do we handle data where certification for one parameter exists but not for all parameters measured?

All data flows through interface and once data is in the system, it flows

#### **Device Certification**

Marketing vs. Testing & Certification

Working with ICAR is not the same as ICAR-Certified

Benefits of ICAR testing & certification





#### Measures or Parameters Need to be Defined

### Define the parameter and recording period – for example...

- 7 consecutive days BCS
- 30 consecutive milkings SCC
- a fraction (240 seconds) of the milking session - MS

#### Other data to be captured

- animal ID
- date/time stamp
- parlour/stall location where applicable
- sensor device name/type
- define other linked data or traits





### Is the Data Real?

#### Handling of missing data points

- How are missing points estimated?
- Mean of actual data only?

Outlier handling and exclusion

**Data smoothing** 

**System Bias or System Adjustment?** 

Range of accurate measurement

#### **Evaluation of algorithm**

- Test data set to send through system algorithm to validate output?
- Protecting IP must be a consideration





#### Merging Multiple Streams of the Same Data



- Producer may contribute information for the same parameter from different measuring devices
- Need to capture not only data point(s) but also source of the data

How will we value each data point?
How will we value the whole record?
What information will we deliver?





## How Will We Value Sensor Data?

The Same
Parameter May
Be Estimated
by Different
Methods with
Different Data
Values
Assigned for
Each Method

#### **Equivalency to Traditional Test Day Data**

 Define parameters that approximate the accuracy and precision of traditional milk recording parameters like milk yield or composition

#### Separate Classes of Data

 Currently A & B Test Types – will we have a test type or class for specific sensor data

#### Weighting of Data

 Data collection rating system that puts relative weight on data type, collection interval, and parameters measured

#### **Use Validated Data Directly**

 New parameters may deliver data with acceptable accuracy and precision and the data is used with minimal editing

#### **Exclusion of Certain Data**

 Results from specific parameters may be deemed to be unsuitable for herd recording programs at the present time





# Reference Materials on the ICAR Website

#### Creation of 'Landing Page' for Sensors

- Sensor survey results
- Internal work of SD-TF
- External research
- Proposed guidelines
- Proposed best practices
- Proposed testing and certification requirements

Link to other ICAR SC/WG/TF

Goal is Summer 2018 for Launch





### Goals of the ICAR Sensor Devices Task Force

Classification, Qualification & Potential ICAR Approval of Sensor Devices Dissemination of Recording Guidelines using Data from Sensors Development & Distribution of Best Practices for Data Collection from Sensors





Producers, breeding companies, herd books, recording organizations, and manufacturers are looking to ICAR to establish research-based standards and guidelines for the

usability of sensor device data in their programs.

## Timeline & Delivery



## Sensor Devices Task Force

May 2016

ICAR Board approved creation of Sensor Devices Task Force (SD-TF)

2016-2017

- · Conference calls/web-based meetings
- · Identification of additional expertise
- Development of initial guidelines/standards

June 2017

- Presentation ICAR 2017 in Edinburgh
- Initial concepts on best practices for review

2018

- Collaboration with manufacturers and database administrators
- Launch of sensor resource page(s) on ICAR website
- Dissemination of proposed guidelines to members and manufacturers

Summer 2019

 Proposed revisions to guidelines presented to the General Assembly at ICAR 2019 in Prague for approval

June 2019

 Sensor Device Task Force transfers work to Recording and Sampling Devices Subcommittee



