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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Challenges 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?
Sensor Devices Task Force

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What Can We Measure?

- Body Condition
- Body Weight
- Temperature
- Feed Intake
- Respiration
- Chewing/Eating
- Methane Emission
- Heart Rate
- Rumination
- Mobility
- Hoof Health
- Animal Location
- Standing/Resting/Movement
- Milk Yield
- Milk Composition
- Milking Speed
- Milk Flow Rate
- Estrus/Pregnancy
- Mastitis
- Pathogens
- MUN
- Ketosis
- VFAs
- Johne’s
- BVD
- BLV
- Milk Yield
- Milk Composition
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- 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 measures
- SD-TF grouped into five main categories

- Milk Yield & Composition
- Milk Flow Rate & Duration
- Live Body Measurements
- Live Activity Measurements
- Feed Efficiency Measurements
Multiple Ways to Classify Sensor Data

Different Needs for Accuracy & Precision
Reviewing Sensor Devices

- What does the sensor measure?
- What is the accuracy and precision of the measurement?
- How is the device calibrated and maintained?
- We cannot determine suitability of data until we know and understand the measurement.
What are We Measuring?

- Mastitis
- Milk Quality
- 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 Technology

- Technology is Improving and Changing Rapidly and Easily Adopted by Producers
- Many Isolated Packages without Integration or Linkage
- Sensor Users Behave as a ‘Community of Practices’ – no True Standards or SOPs
- Validation, Maintenance, and Calibration Protocols are Missing
- There is System Bias and Individual Sensor Bias
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**

**Devices that Measure Multiple Parameters**
- 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
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

ICAR

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