Summary of Sensor Devices Task Force Work and Charting a Course Moving Forward

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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?
Data Capture & Flow Challenges

- Quality of LAN or Internet Connection at Dairy
- Many Different Versions of Software – Updates Not Installed
- Frequent Updates of Software Creating Data Field Errors
- Random or Arbitrary Data Fields Created by Dairyman
- Lack of Real-Time Connection – May Only Be Daily or Weekly
- System is Too Complex/Labour Intensive for Dairy
- Inconsistent Data Definitions
- Data Quality – Missing or Incomplete
- ID Truncation/Translation/Cross-Referencing
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 both System Bias and Individual Sensor Bias
SD-TF Survey – Priorities Identified by Members

- Milk Yield & Composition
- Milk Flow Rate & Duration
- Live Body Measurements
- Live Activity Measurements
- Feed Efficiency Measurements
New Sensor Device Page on ICAR website

Links to:
- Survey Results
- Sensor Summary Table
- Trait Characterization/Validation
- External Research/Publications
- Draft Guidelines (upcoming)
Reviewing Sensor Devices

What does the sensor measure?

What is the accuracy and precision of the measurement?

How is the device calibrated & maintained?

We cannot determine suitability of data until we know and understand the measurement.
Multiple Ways to Classify Sensor Data

Different Needs for Accuracy & Precision

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

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
Add New Section to Guidelines

Overview of Data Use from SD Systems
Automated Animal ID & Data Capture
Data Connectivity
Data Credibility
  * Missing Data Points
  * Outlier Handling
  * Data Smoothing
Data Transfer and Usability Standards

Linked to Specific Performance Standards in Other Sections of ICAR Guidelines.

Linked to Sensor Device/System Testing Guidelines (Section 11)
Animal ID is More Important Than Ever

- The ‘official ID’ of an animal most likely will not be the same as ID associated with sensor measures.
- Animals may have multiple IDs over their lifetime.
- Animals may have multiple IDs on their body at once.
- Databases will need to have protocols for ID cross-referencing and validation.
- Need protocols for on-farm validation of the ID system and for data transfer/custody.
Reliable Data - Auto ID Systems

Example: 2x20 Parlor, ID at the entrance

ID rate 98%
- 100 cows = 5 loads
- 98% ID = 2 cows missed in 5 loads
- On average the missed cow is in mid load

Data of 10 cows is assigned to wrong cows

RESULT: DATA RELIABILITY = 80%
20 cows out of 100 assigned with wrong data
Raw Data vs. Estimated Data vs. Displayed Data vs. Usable Data

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

Outlier handling and exclusion

Data smoothing

Range of accurate measurement for sensor

Data Precision

Evaluation of algorithm
- Test data set to send through system algorithm to validate output?
- Protecting IP must be a consideration
Connectivity is a Concern

How is the value computed?

Estimations?

Mean values without missing data?

Affects the quality of data entering the system
How Will We Value Sensor Data?

**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 Supervised or Owner Sampler 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
Data Usability Standard

Standard Template for each Measurement

Includes Data Use, Species, System and Scheme along with A, R, & R

Overview of use described in new section of ICAR Guidelines

SC/WG with expertise will adopt format and provide performance standards for each trait or measurement

Brings clarity to manufacturers & MROs
Guidelines for Sensor Device Testing, Approval, Calibration or Routine Checking Procedures will be added to Section 11. Draft Guidelines under Review and will be handled by RSD-SC. Target November 2019 followed by ICAR Board review and vote by General Assembly.
Revisions to Section 11

Section 11 - Guidelines for Testing, Approval and Checking of Recording and Sampling Devices
List of Procedures

- [Procedure 1] Procedure for Application for Testing of Recording and Sampling Devices or Sensor Devices and/or Systems
- [Procedure 2] Procedure for Testing of Traditional Milk Recording and Sampling Devices
- [Procedure 3] Procedure for Testing of Automatic Milk Recording and Sampling Systems
- [Procedure 4] Procedure for Testing of Sensor Devices and/or Systems
- [Procedure 6] Procedure for Evaluation of Installation and Routine Calibration Procedures for Sensor Devices and/or Systems
- [Procedure 7] Procedure for Computerized Solutions for Periodic Checking of Recording and Sampling Devices
- [Procedure 8] Procedure for Computerized Solutions for Periodic Checking of Sensor Devices and/or Systems
- [Procedure 9] Procedure for Test-Day Practices Using Recording or Sensor Devices and Electronic Identification Simultaneously
- [Procedure 10] Procedure for Test-Day Practices for Obtaining Milk Samples on Individual Animals from Sampling Devices
- [Procedure 11] Procedure for Labeling of ICAR-Certified Devices
- [Procedure 12] Procedure for Annual Reporting of ICAR-Certified Devices in the Marketplace by Manufacturers
- [Procedure 13] Procedure for Annual Reporting of ICAR-Certified Device Usage and Satisfaction by Member Organizations
- [Procedure 14] Procedure for ICAR Certification of Devices
ICAR Universal Coding Systems for Devices

Development and delivery by Interbull (tentative) on behalf of ICAR

Will include traditional recording devices and sensor devices/systems

Allow for data source characterization by member organizations, data handlers and data users

In addition to device code, system would include:

- Manufacturer
- Software Name
- Data measured
- Device Name
- Software Version
- ICAR Status
- Other Marketplace Names
- Firmware (if applicable)
- ICAR Status Date
Work of SD-TF concludes at ICAR 2019 in Prague

Recording and Sampling Devices SC (RSD-SC) assumes responsibility for guidelines revisions

RSD-SC develops new testing protocols and continues manufacturer outreach

ICAR SC and WG adopt data usability standard, providing performance standards for each sensor measurement or trait

Interbull works with RSD-SC to develop and deliver universal coding system for all devices

ICAR Board to set direction with respect to appropriate level of certification, approval, verification, validation or other term for sensor devices/systems and data generated from them.