Practical Accuracy Limits for On-Farm Milk Analysers

Rob Orchard, MSD, New Zealand

MSD Animal Health
The Science of Healthier Animals®

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Full title: Considerations for the Establishment of Practical Accuracy Limits for On-Farm Milk Analysers for Official Milk Recording

Key Points

Orient accuracy limits towards the goal of genetic improvement

Define accuracy limits in terms of milk component yield

Enable trial designs that evaluate cow-specific bias

Set accuracy limits to ensure useful ranking of high and low performing cows

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Decisions from Milk Data

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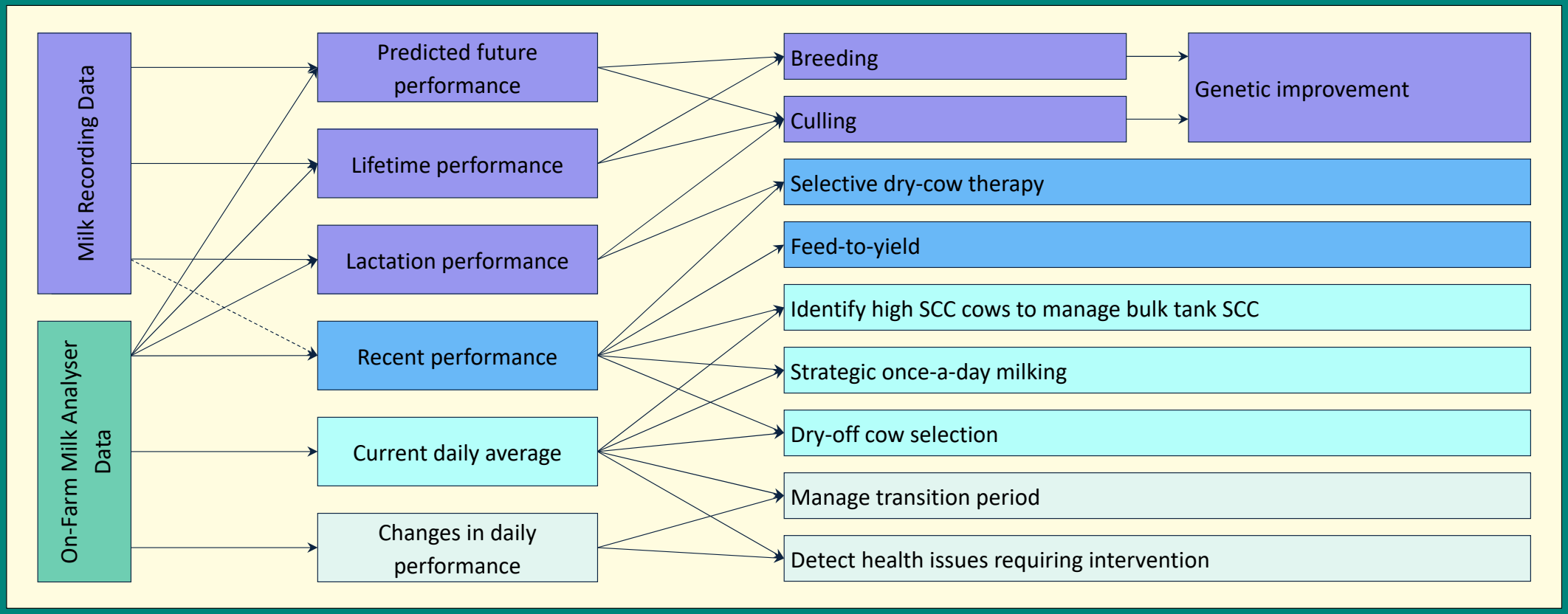
Decisions from Milk Data



- Milk recording data is not useful for monitoring short-term cow performance
- Genetic improvement is driven by decisions made on long-term cow performance

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ICAR Accuracy Limits

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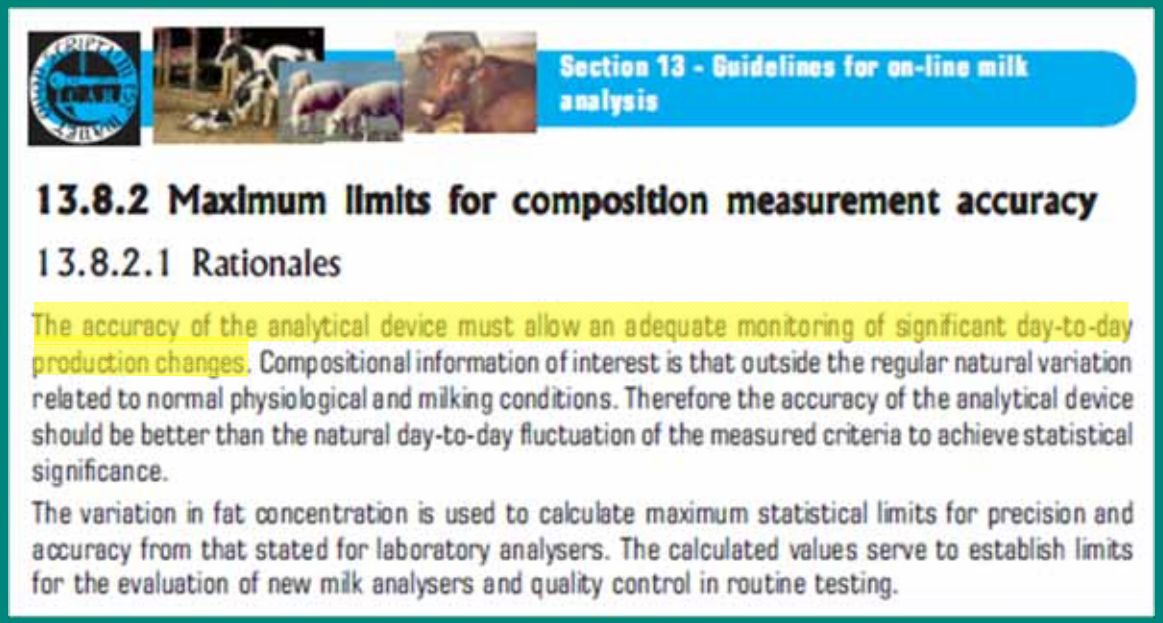
ICAR – Section 13 – Guidelines for On-Line Milk Analysis (2012)

2012



Section 13 - Guidelines for on-line milk analysis

13.8.2 Maximum limits for composition measurement accuracy

13.8.2.1 Rationales

The accuracy of the analytical device must allow an adequate monitoring of significant day-to-day production changes. Compositional information of interest is that outside the regular natural variation related to normal physiological and milking conditions. Therefore the accuracy of the analytical device should be better than the natural day-to-day fluctuation of the measured criteria to achieve statistical significance.

The variation in fat concentration is used to calculate maximum statistical limits for precision and accuracy from that stated for laboratory analysers. The calculated values serve to establish limits for the evaluation of new milk analysers and quality control in routine testing.

ICAR's original accuracy limits were based on monitoring day-to-day production

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ICAR – Section 12 – Evaluation of Milk Analysers for ICAR Certification

2025

2 General Overview for Milk Analyser Evaluation

ICAR distinguishes between data use in the frame of official milk recording and for other [Collapse] farm management purposes. Section 12 of the ICAR Guidelines lists principles and procedures developed for verification of milk analyser systems against ICAR requirements in the frame of official milk recording and for validation of submitted claims with milk analyser systems for other purposes.

ICAR verification of milk analyser systems means performance evaluation according to stated testing and verification protocols for milk analysers for official milk recording purposes by an ICAR appointed Test Centre. In case of a successful verification, it has been demonstrated that the milk analyser system can deliver data as described in the test report and it meets the ICAR requirements as listed in Table 4, provided that the analyser is applied and operated according to the instructions of the manufacturer and with proper quality assurance in place when applied in routine.

On-farm milk analysers used in official milk recording should meet ICAR accuracy requirements

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ICAR Accuracy Limits for On-farm Milk Analysers

ICAR accuracy limits for on-farm milk analysers are held as the standard for use in official milk recording

Opportunity to evolve the guidelines towards a new baseline aligned with genetic improvement

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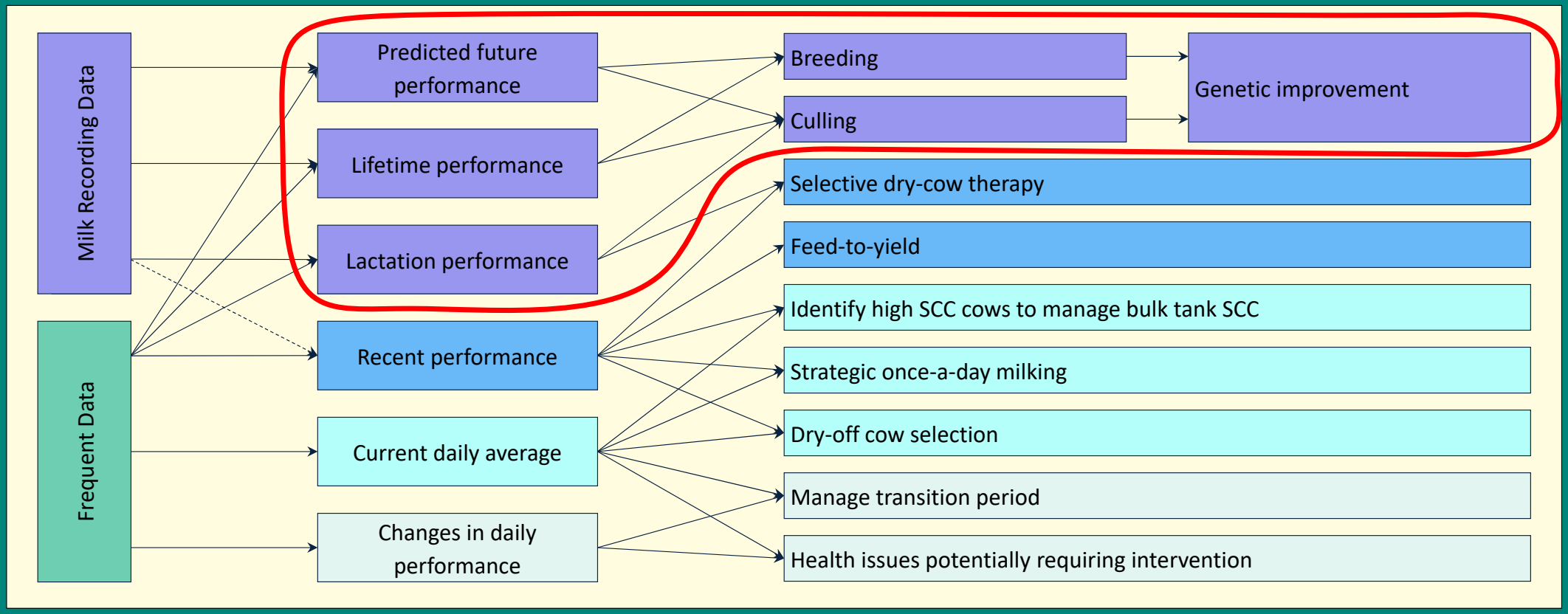
What is the Relevant Timescale?



- Accuracy limits should ensure good measurement of long-term cow performance

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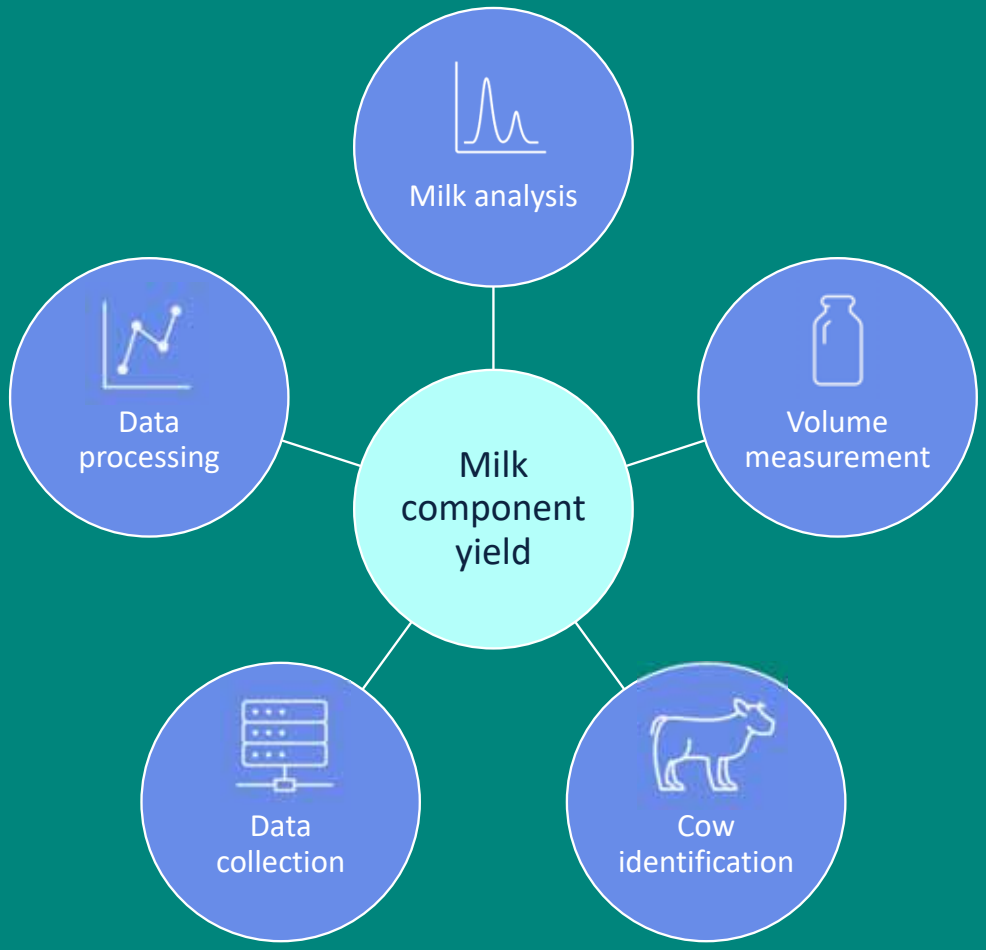
The Opportunity

Evaluate accuracy of milk component yield



- Cows are primarily valued on milk solids production, not concentration
- Multiple parts of the system contribute to the accuracy of milk component yield
- Accuracy could be improved by enhancing any part of the system
- It makes sense to define accuracy limits in terms of the relevant cow-performance measure
  – milk component yield

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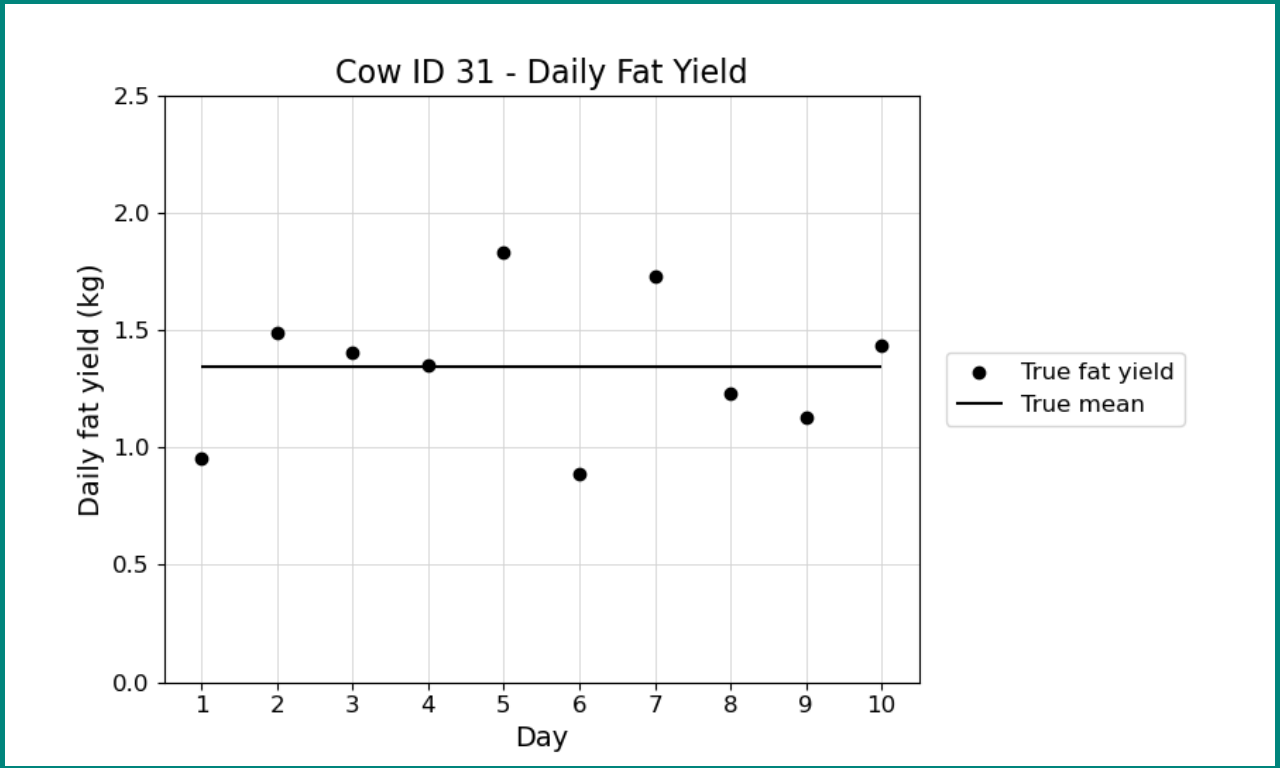
Frequency Beats Precision

Day-to-Day Variation

Cow-Specific Bias

Day-to-Day Variation



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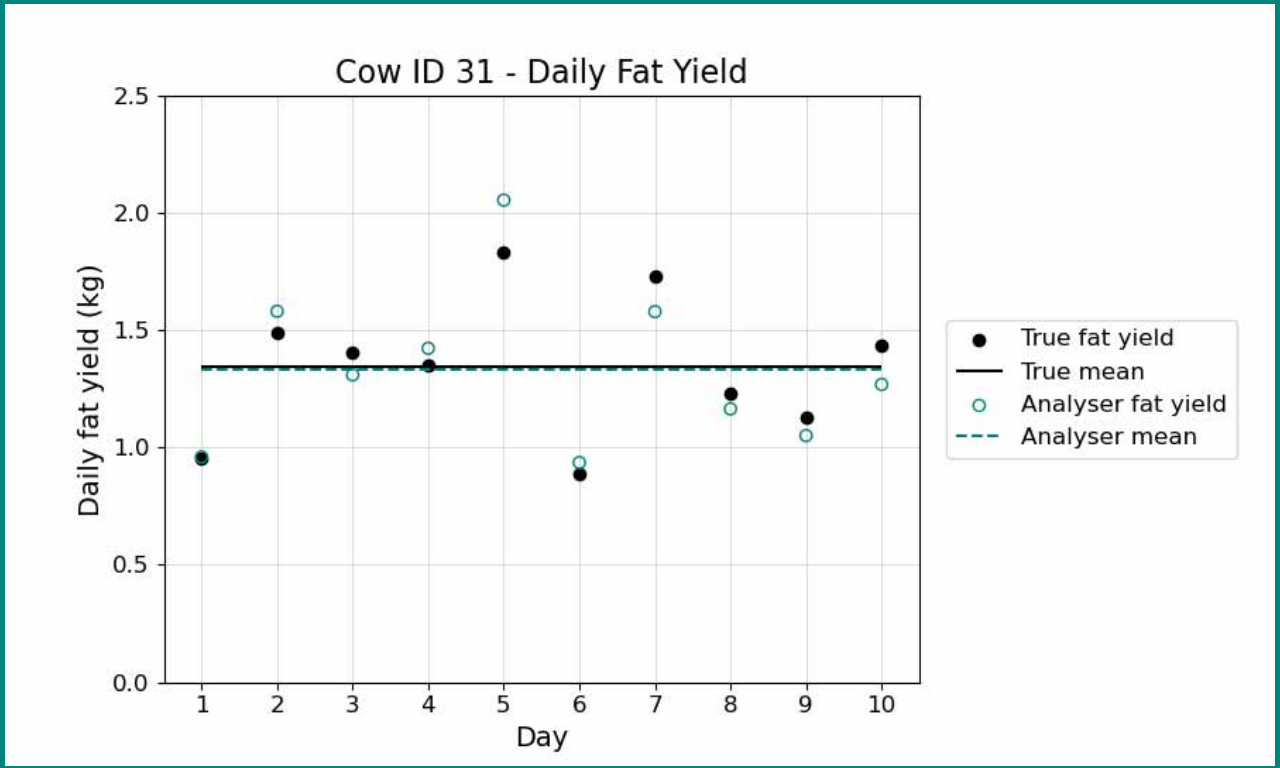
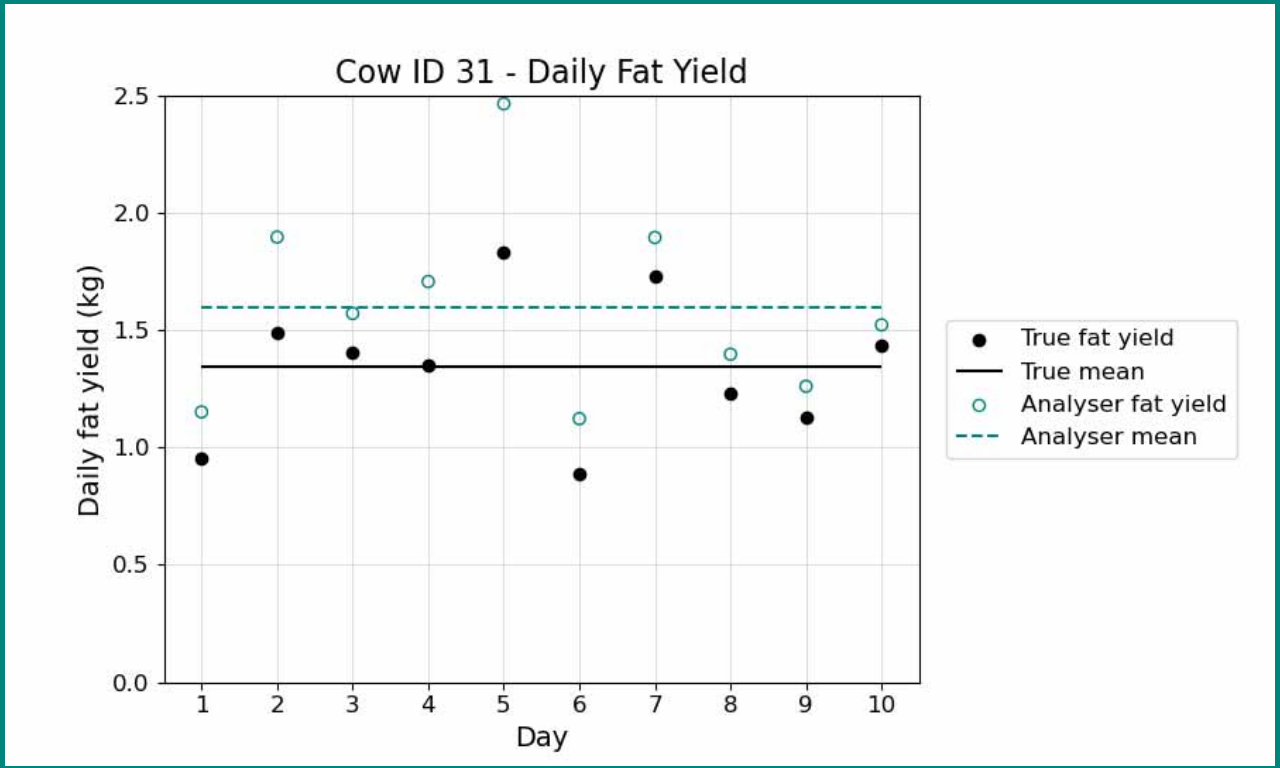
Frequency Beats Precision



Cow-Specific Bias



Cow-Specific Bias

Cow-specific bias is the accuracy metric that determines the ability to compare cows' long-term performance

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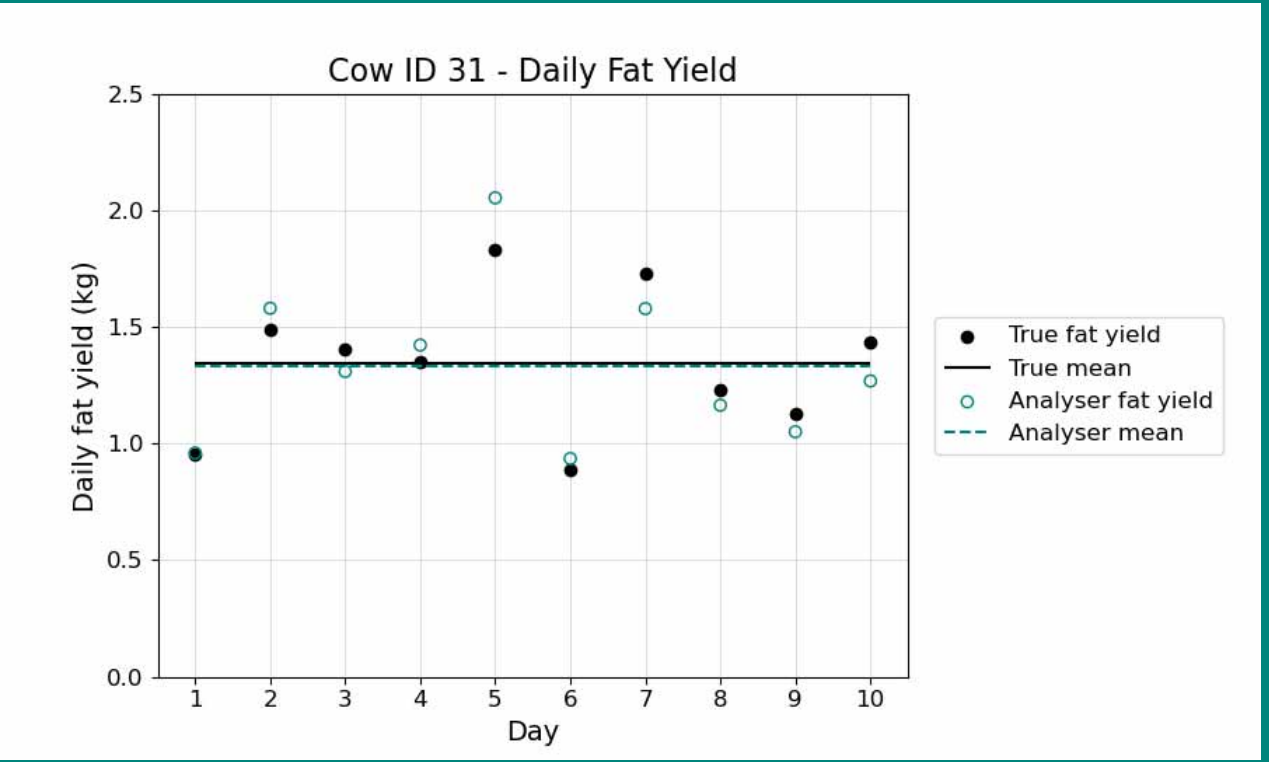
Designing Trials to Assess Cow-Specific Bias

- Multiple ground-truth measurements for each cow
- Evaluate SD error of cow-aggregated data
- E.g. a ten-day block test with milk recording throughout, evaluating SD error of cow mean



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Why is it Important?

Consider two hypothetical analysers, equivalent for breeding and culling decisions

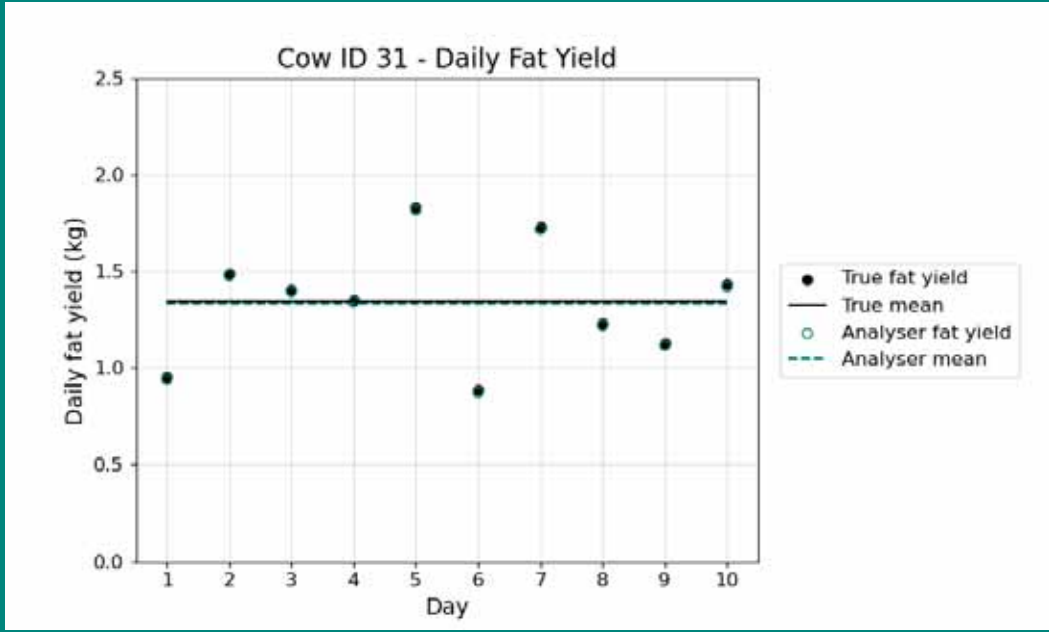
Analyser A

- Low SD of individual test error
- Low cow-specific bias

→ Excellent estimates of short-term and long-term cow performance

→ Can be evaluated by bucket test

Fits existing ICAR framework



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Why is it Important?

Consider two hypothetical analysers, equivalent for breeding and culling decisions

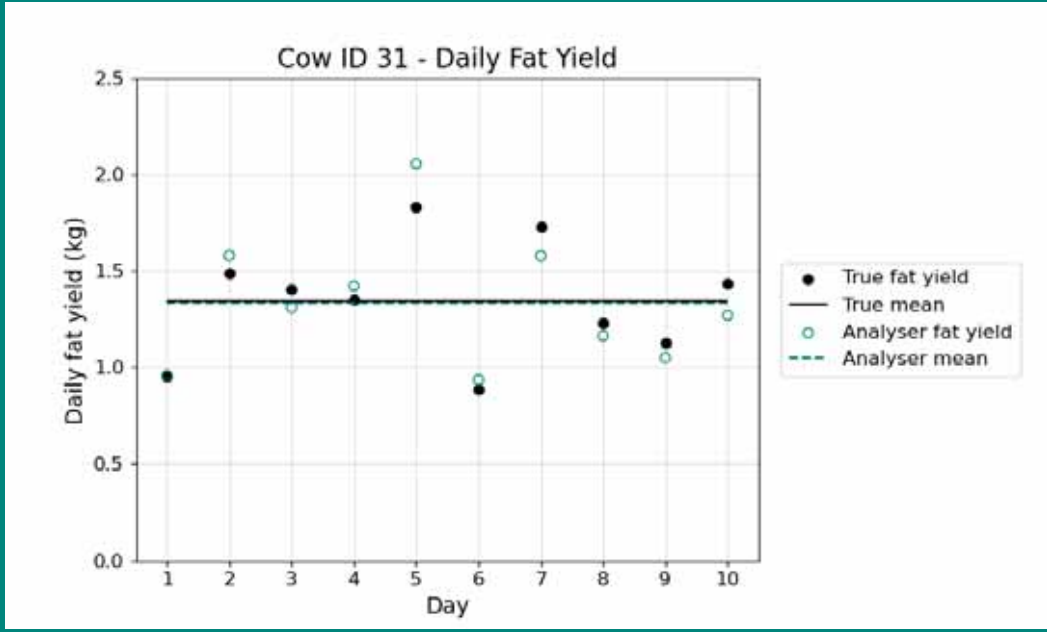
Analyser B

- Lower cost than Analyser A
- Mediocre SD of individual test error
- Low cow-specific bias

→ Indicative estimates of daily cow performance

→ Excellent estimates of long-term cow performance

Opportunity to extend the ICAR framework to support this analyser



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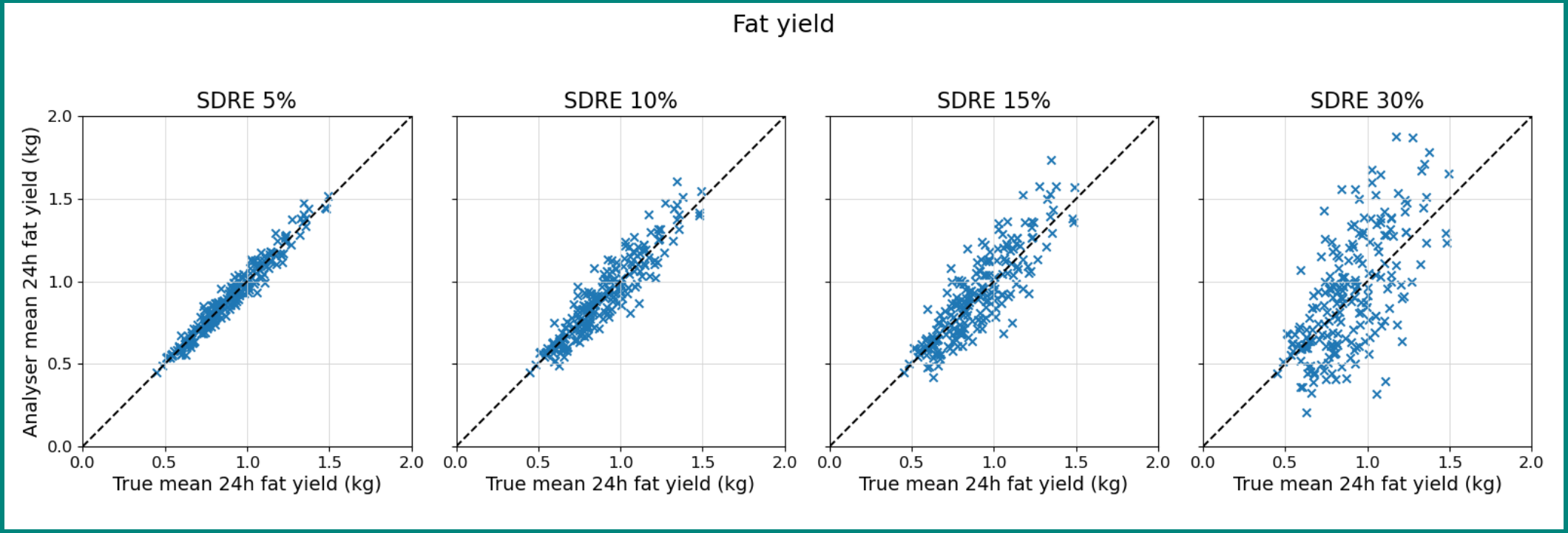
Setting the Accuracy Limit

Set a level that allows high and low producing cows to be identified to support genetic improvement



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Thank you

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