Comparison of records from in-line milk meters and conventional herd testing for management and genetic evaluation of dairy cows

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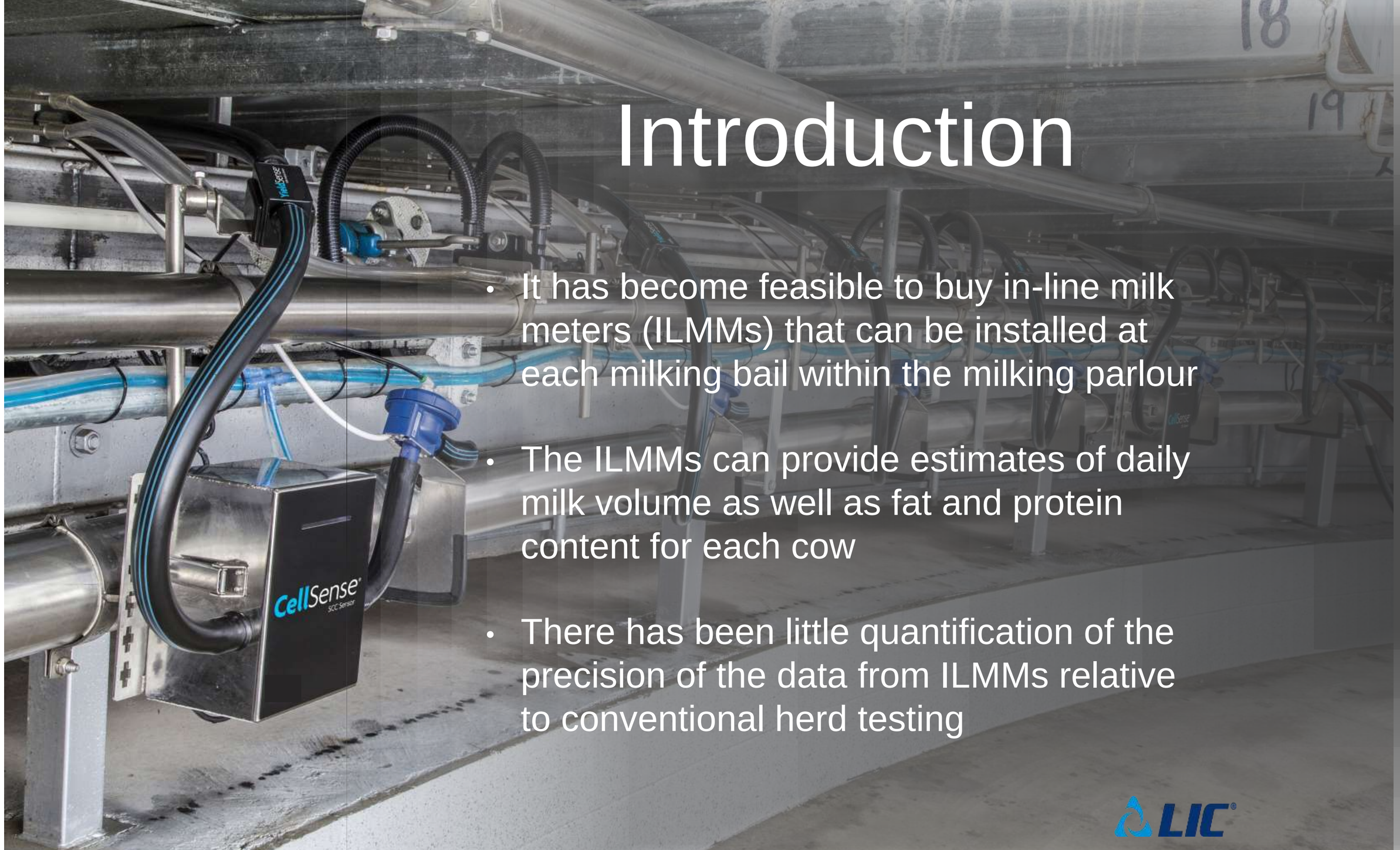
Introduction

- Data from herd testing and animal recording are essential inputs for modern genetic improvement programs for dairy cattle
- Outcomes:
  - To identify genetically superior animals for breeding
  - To identify low-value cows for culling
  - Input for management decisions

Introduction

- Herd testing is usually undertaken by herd testing organisations
- Herd testing samples are obtained at each visit using ICAR, or nationally certified, herd testing devices
- The fat and protein content is measured from a subsample using FTIR laboratory analysis



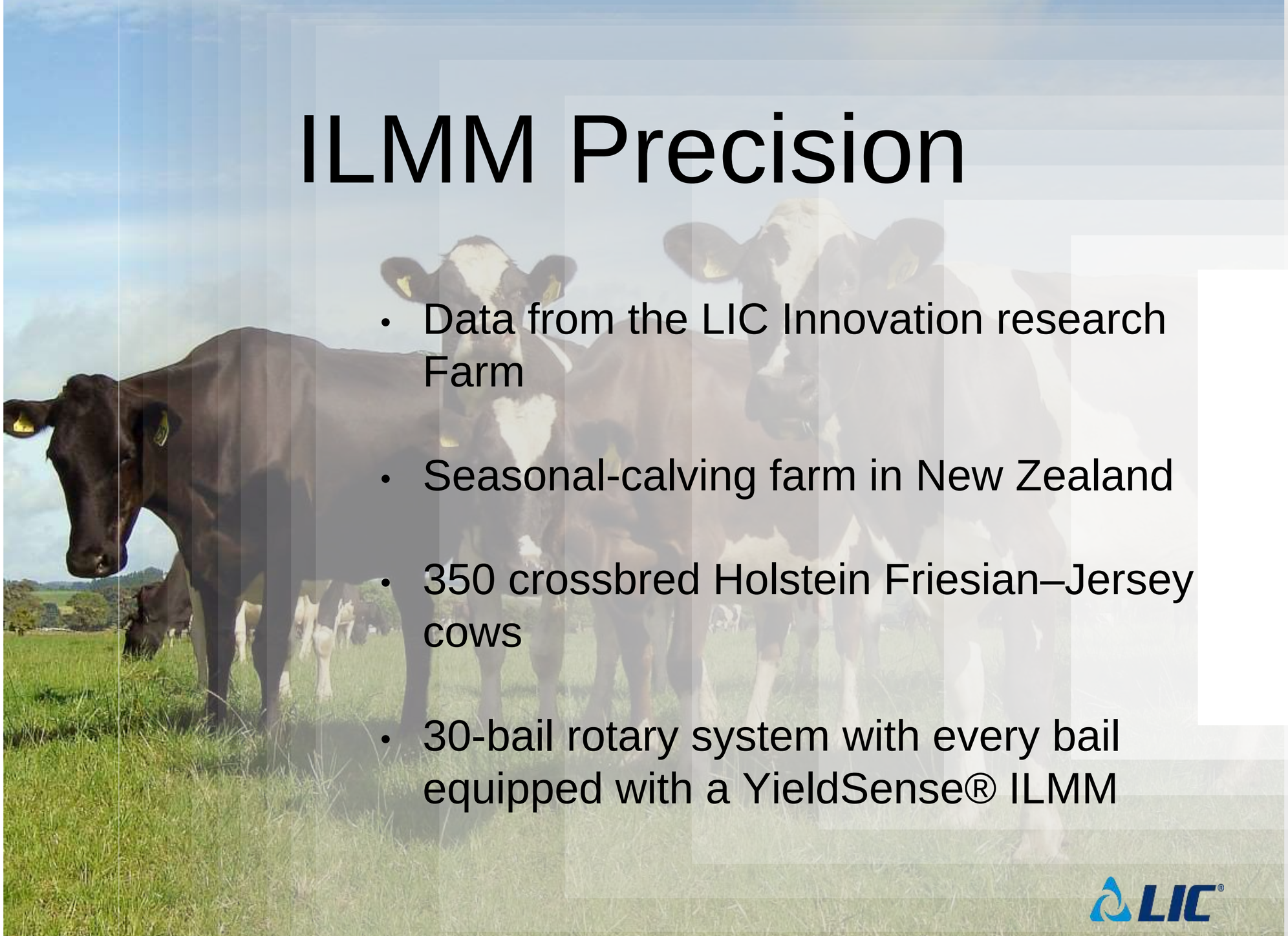
Introduction

- It has become feasible to buy in-line milk meters (ILMMs) that can be installed at each milking bail within the milking parlour
- The ILMMs can provide estimates of daily milk volume as well as fat and protein content for each cow
- There has been little quantification of the precision of the data from ILMMs relative to conventional herd testing

Objectives

- Compare the accuracy of estimating the genetic and productive merit of cows based on either:
  - high-frequency, lower-precision ILMM measurements
  - low-frequency, high-precision conventional herd testing measurements.

ILMM Precision



- Data from the LIC Innovation research Farm
- Seasonal-calving farm in New Zealand
- 350 crossbred Holstein Friesian–Jersey cows
- 30-bail rotary system with every bail equipped with a YieldSense® ILMM

ILMM Precision

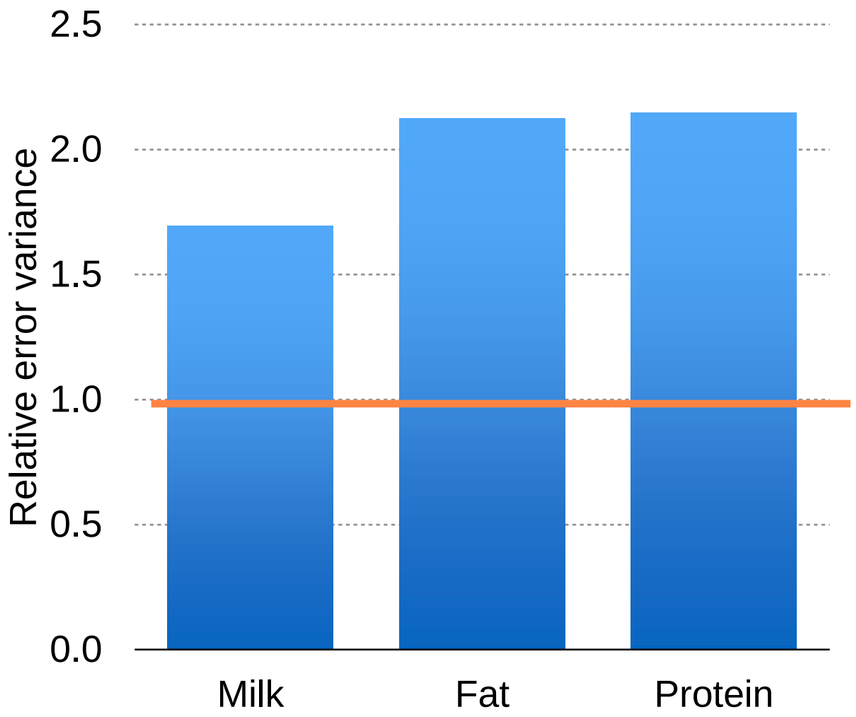
- Data collected from the ILMMs from September 2014 until May 2015
- We undertook 64 conventional herd tests
  - Two blocks of 20 consecutive tests
    - peak of lactation
    - 3rd quarter of lactation
- The data from the ILMM meters were calibrated to the five-day bulk tank averages

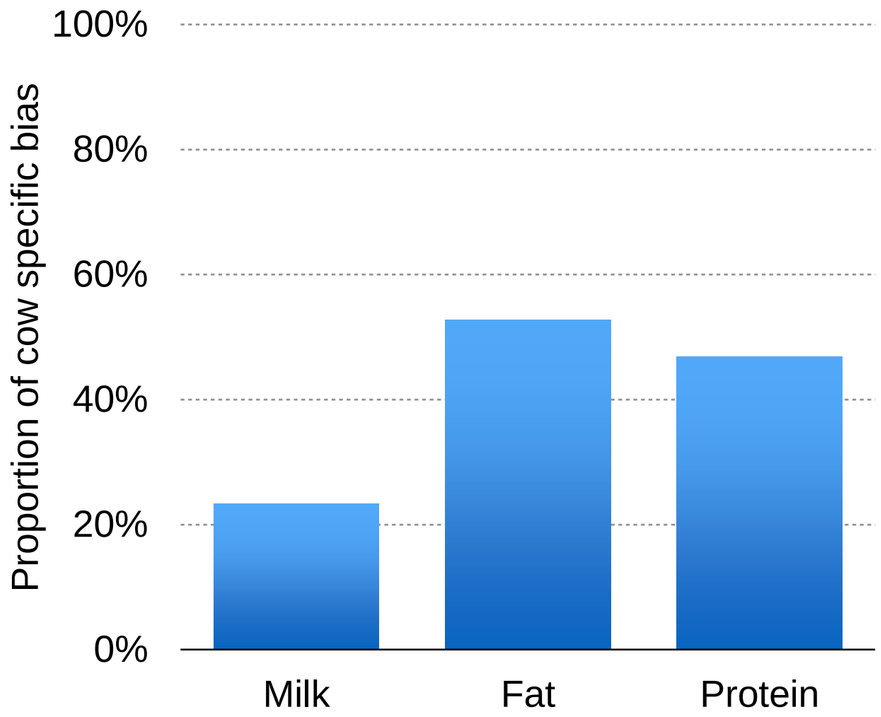
ILMM Precision

- Measurements outside upper and lower limits from the ICAR guidelines were removed
- Outliers were identified within each cow's lactation curve via a spline analysis
- Linear mixed models were used to calculate the accuracy of the ILMM measurements relative to the herd test measurements
  - Accounted for the fixed effects of age, days in milk and breed and the random effects for cow and error

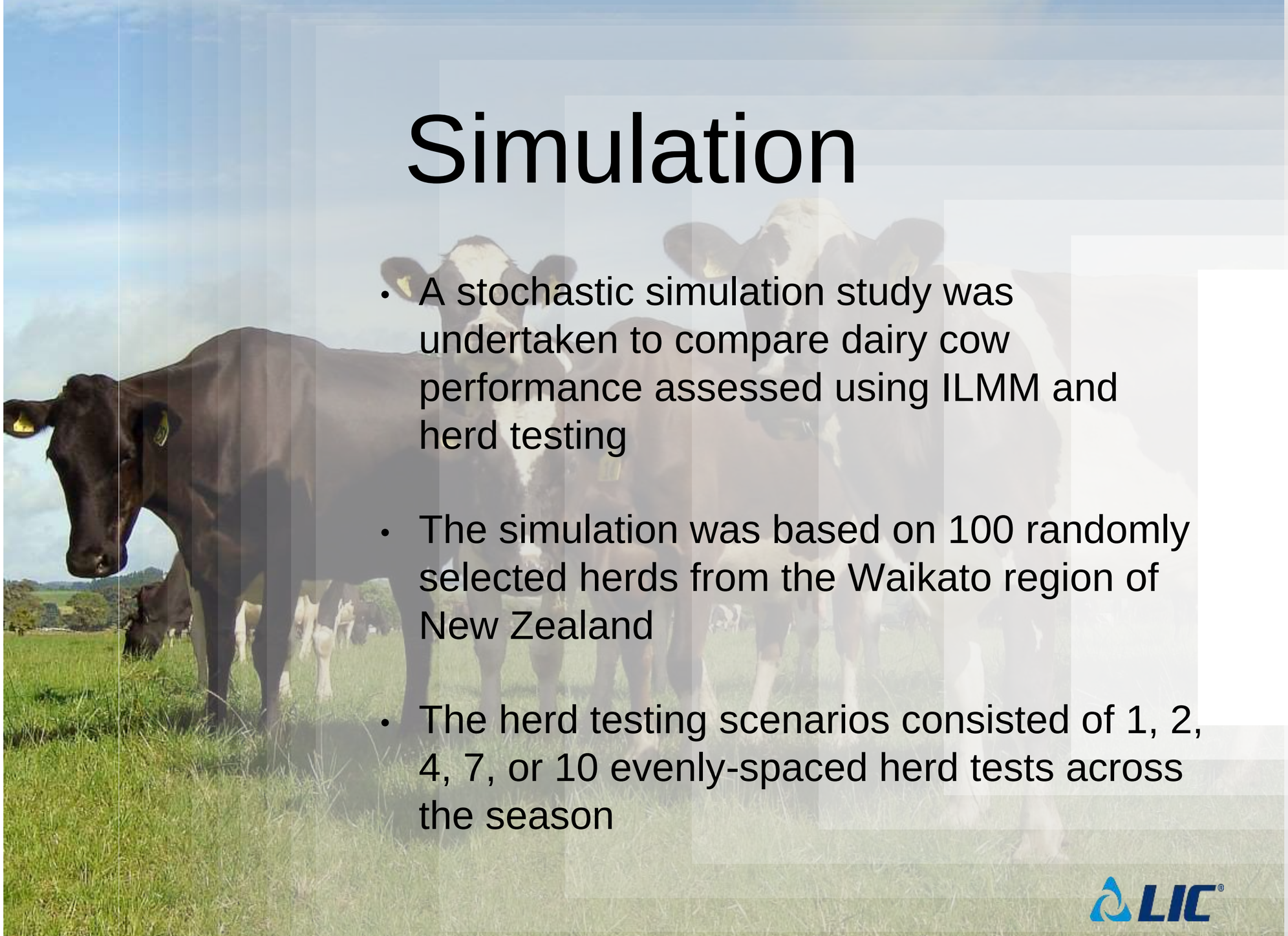
Results

Accuracy and Bias





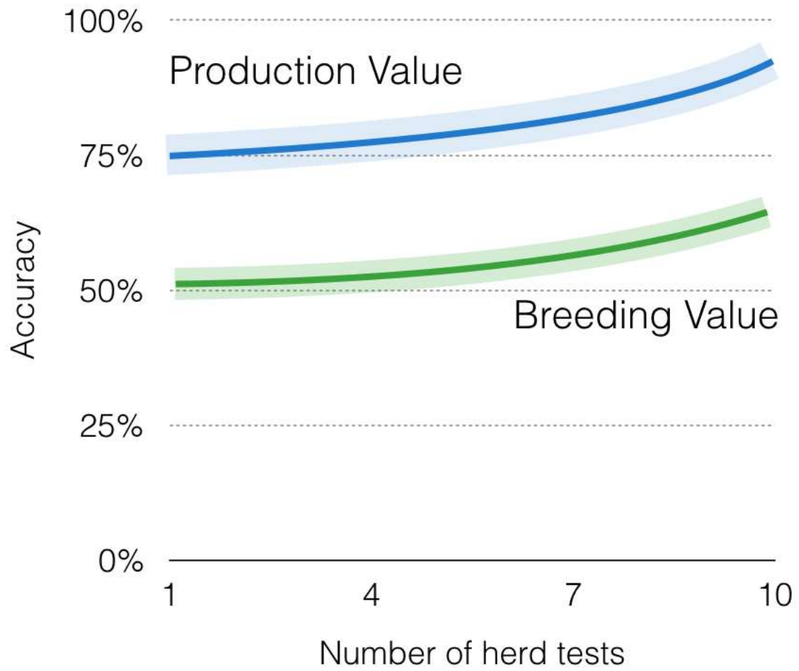
Simulation

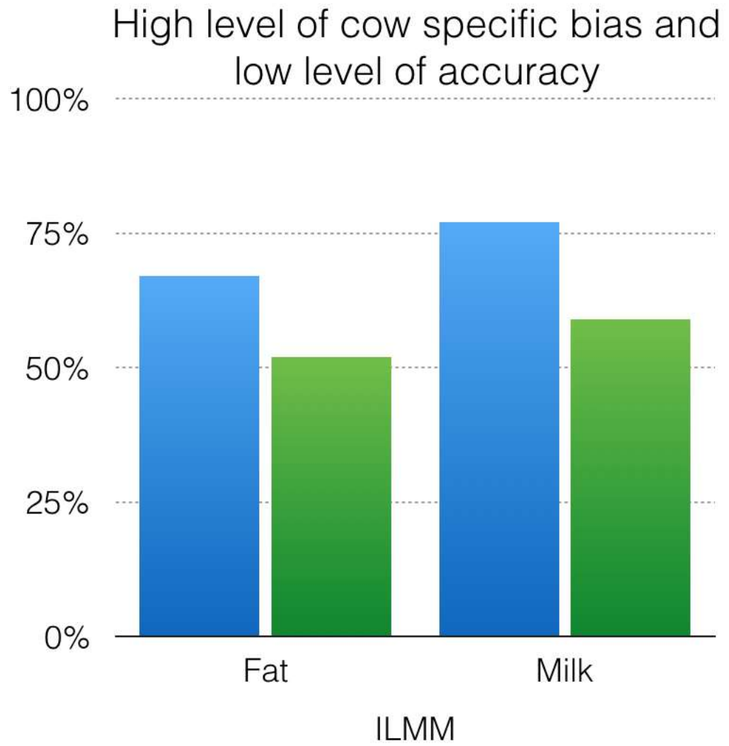


- A stochastic simulation study was undertaken to compare dairy cow performance assessed using ILMM and herd testing
- The simulation was based on 100 randomly selected herds from the Waikato region of New Zealand
- The herd testing scenarios consisted of 1, 2, 4, 7, or 10 evenly-spaced herd tests across the season

Results

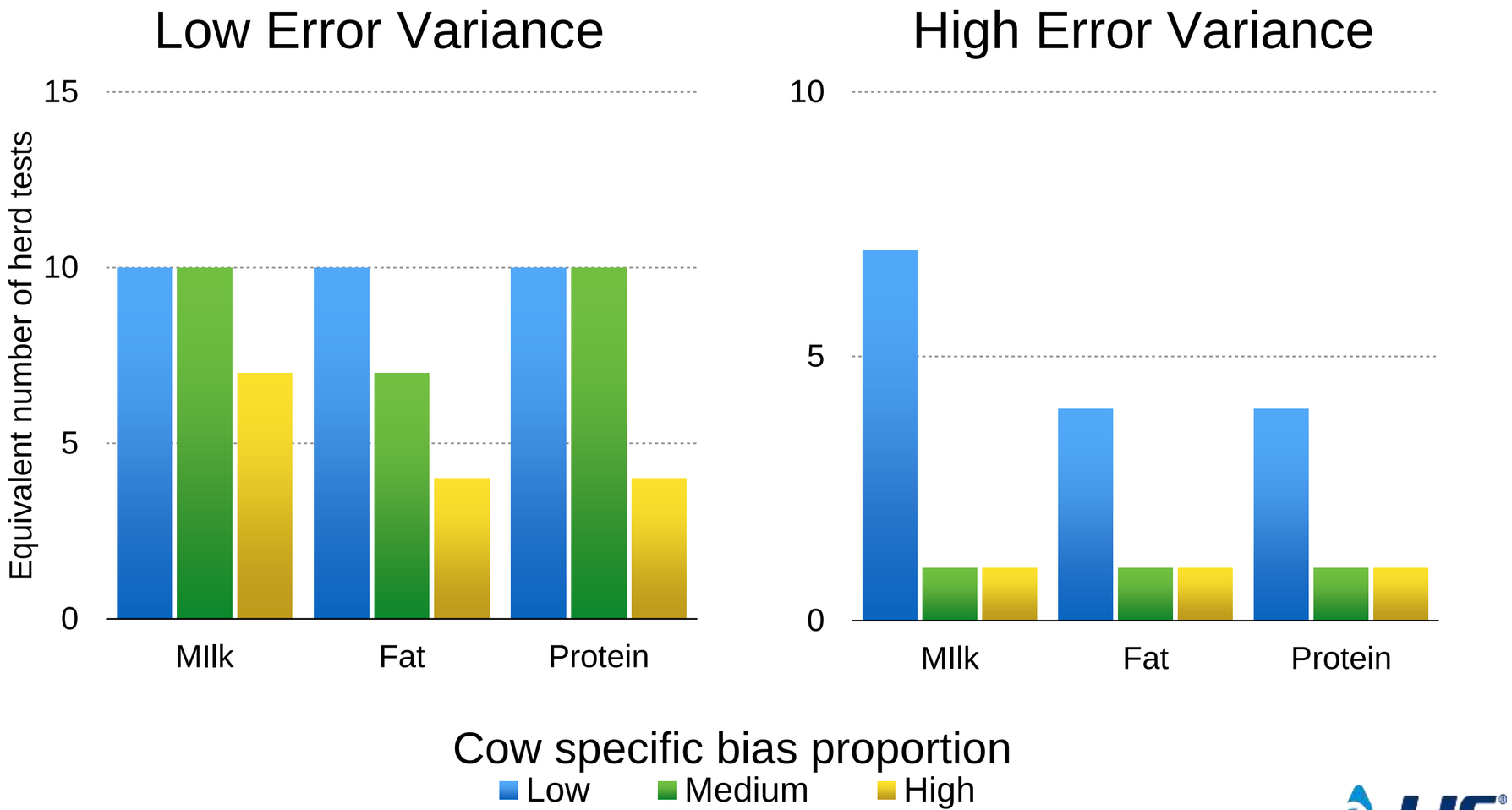
Simulation





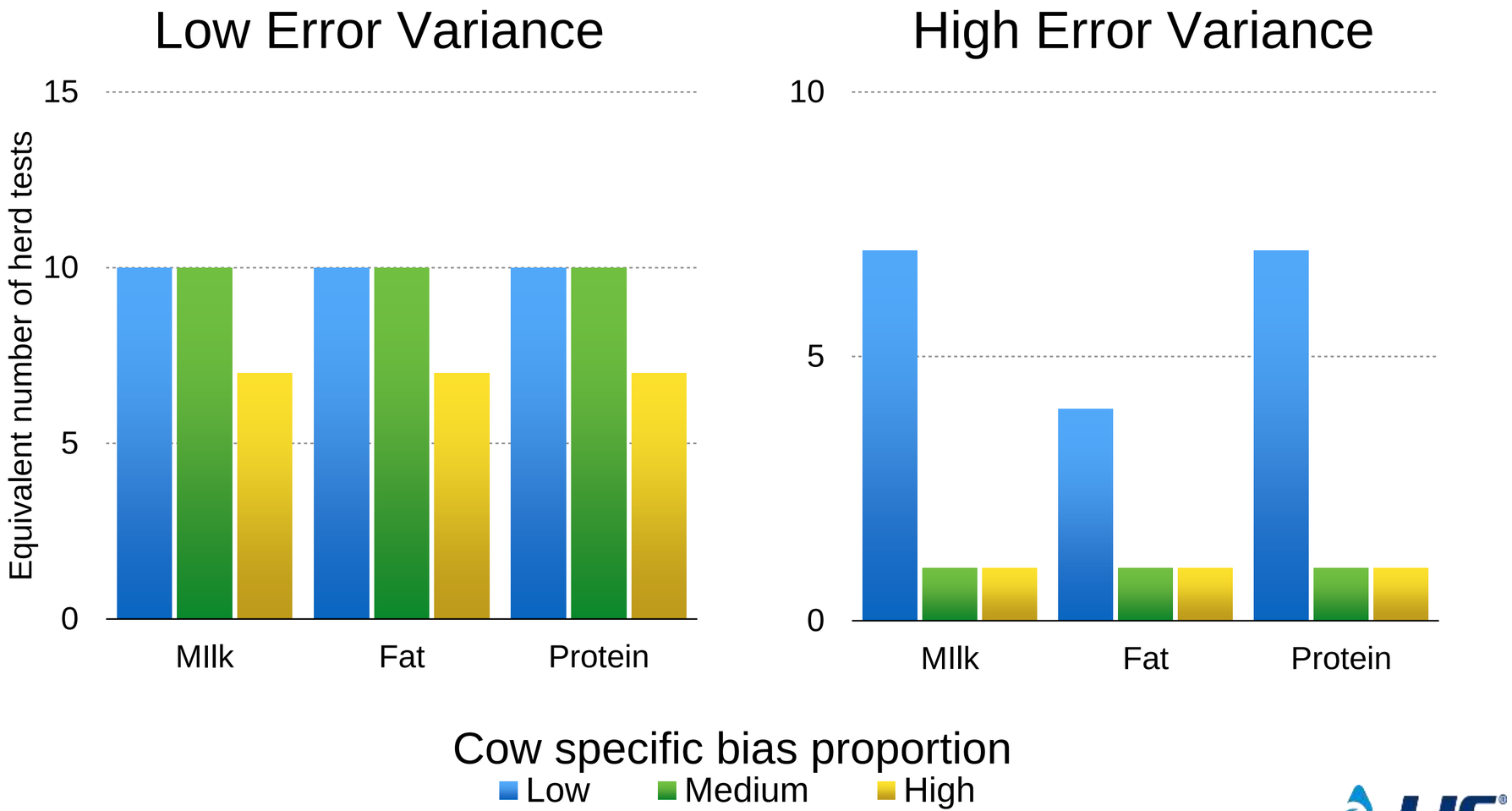
Results

Simulation: Breeding Values



Results

Simulation: Production Values

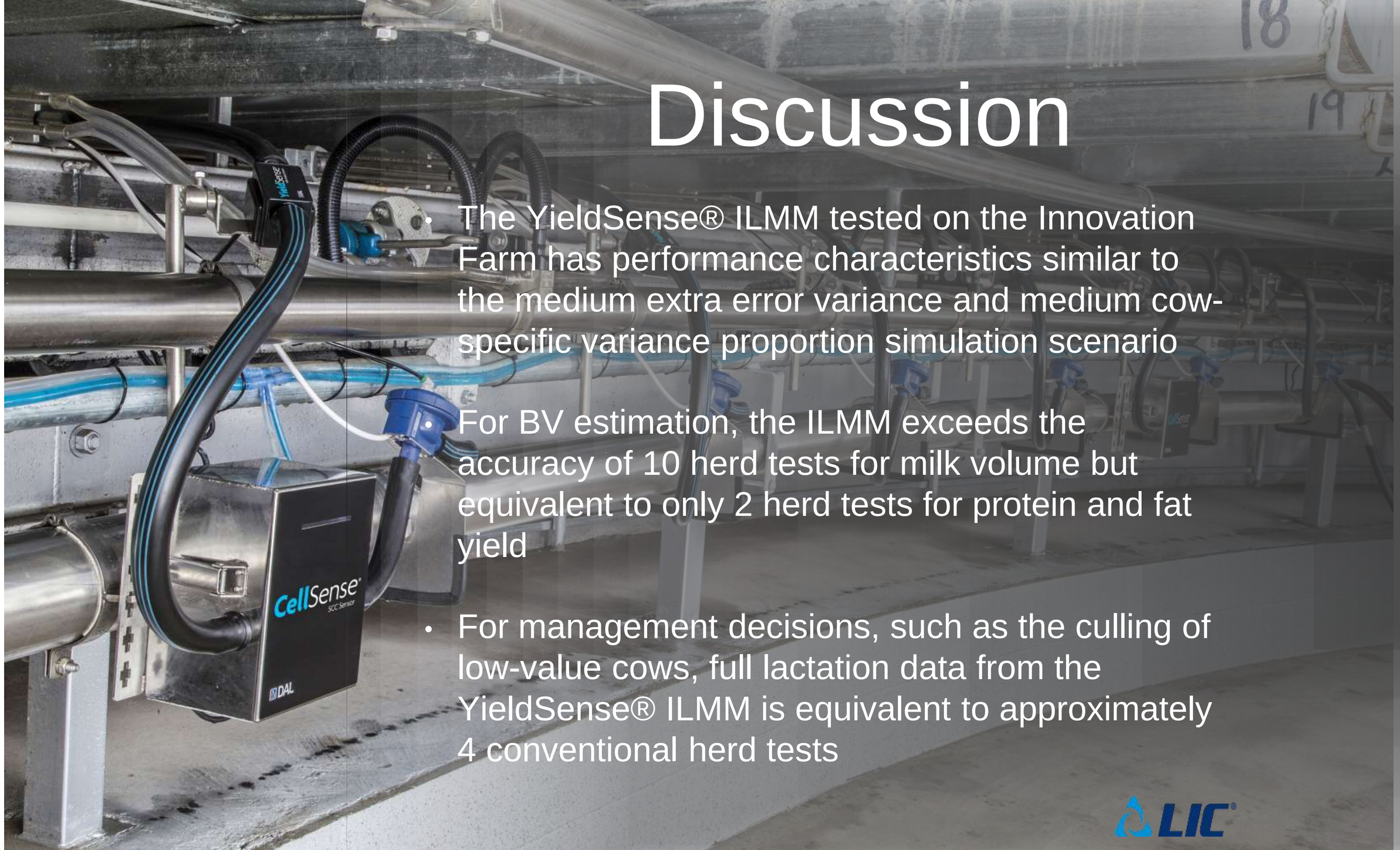


Discussion

- The use of records from an ILMM that have little or low levels of cow-specific variance can match or outperform the accuracy of 4 conventional herd tests for BV and PV estimation

- As the level of cow-specific variance increases, the accuracy of the ILMM, relative to herd testing, decreases.

- The (co)variance structure of the cow-specific variance does have a major impact on the results

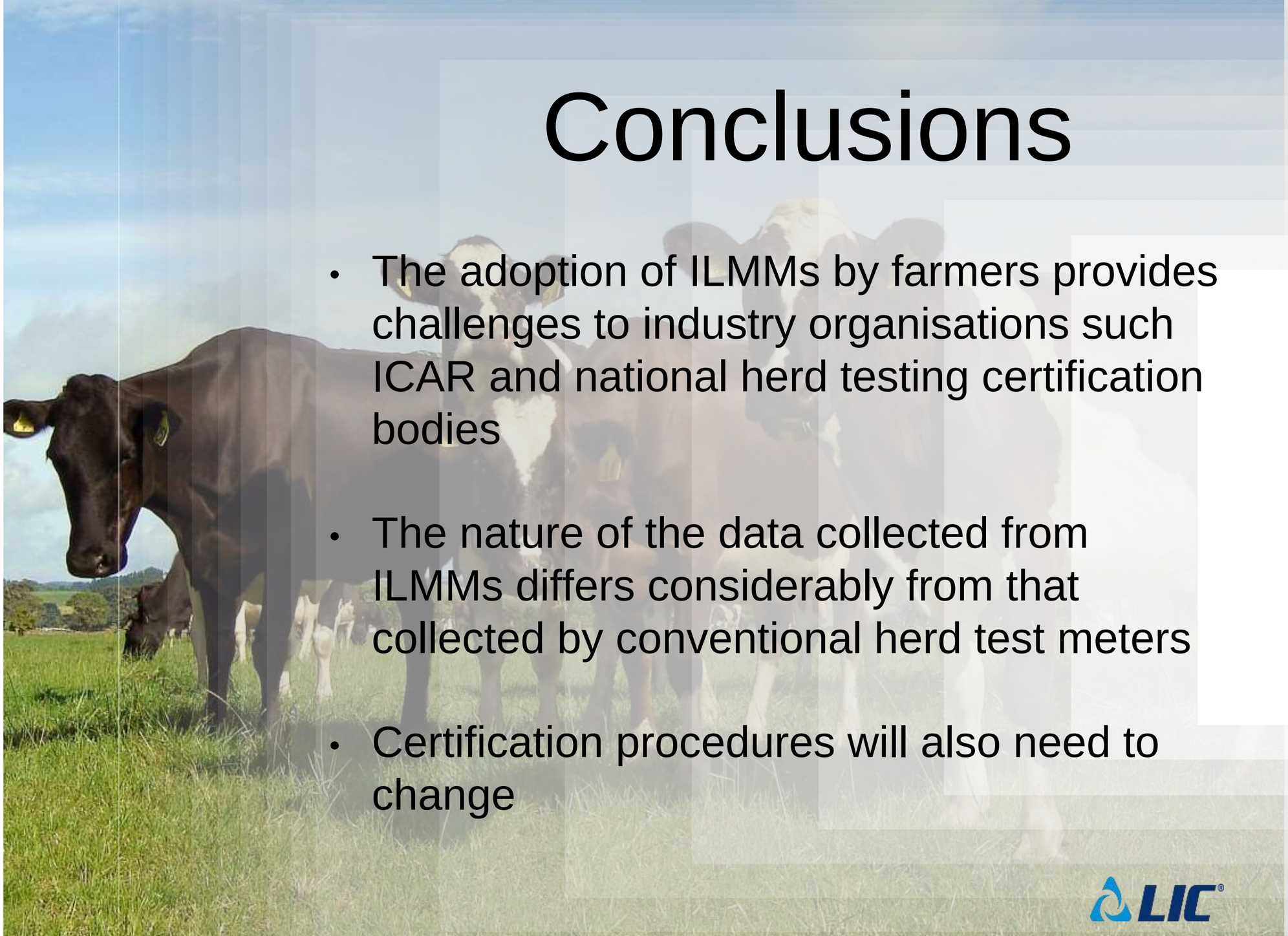


Discussion

- The YieldSense® ILMM tested on the Innovation Farm has performance characteristics similar to the medium extra error variance and medium cow-specific variance proportion simulation scenario
- For BV estimation, the ILMM exceeds the accuracy of 10 herd tests for milk volume but equivalent to only 2 herd tests for protein and fat yield
- For management decisions, such as the culling of low-value cows, full lactation data from the YieldSense® ILMM is equivalent to approximately 4 conventional herd tests

Discussion

- The output from ILMMs must undergo a series of processes such as
  - calibration
    outlier detection
    meter bias removal
- These processes are dependent on data from the entire milking platform, and may require repeated measurements on individual cows.
- Given the evidence of cow-specific bias from the ILMM
  - Certification process will likely require tests of bias across different cows and breeds, range of milk compositions and time.



Conclusions

- The adoption of ILMMs by farmers provides challenges to industry organisations such ICAR and national herd testing certification bodies
- The nature of the data collected from ILMMs differs considerably from that collected by conventional herd test meters
- Certification procedures will also need to change

Questions?