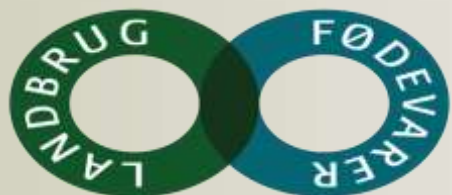




TS5 – SUPPORTING TECHNOLOGIES FOR ANIMAL PRODUCTION COLLECTION DATA

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RYK provides milk recording for dairy cows. RYK are collecting annually about 5.5 million milk samples, serves 3.000 dairy farmers, and have a turnover of 16 million euro. We have 65 employees, and offices in Aarhus, Sorø, Holstebro, and Vojens.



Test day milk yield and composition records are affected by deviations in milking intervals in overly simplified recording schemes

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The issue

- Milk recording is a workload – it takes time and cost money
- Can it be simplified further and still be valuable?

This investigation:

- How large is the increase in "noise" and "bias" in reduced recording schemes, relative to a standard, 2X measure and sample scheme ?

Full and reduced recording protocols for 2X milking

- Full: 2X recording / 2X sampling
- Common: 2X recording / 1X sampling - pm/am - alternating
- Reduced: 2X recording / 1X sampling – am
- 1X recording – full interval info / 1X sampling – am
- 1X recording – “fixed interval” / 1X sampling – am
- 1X recording – no interval info / 1X sampling – am

Target traits: test day milk and ECM yield

- Milk yield kg / 24 h
- Fat yield kg /24 h
- Protein yield kg / 24h
- **ECM kg / 24 h**

Supplementary covariates and factors:

- Milking interval, hours
- Days in milk > grouped: 1-30; 31-90; 91-180; 181-305; 306+
- Parity > grouped: 1, 2, 3+



24 hour yields are predicted by extrapolation on recorded variables – using linear regression

Example, 2X recording / 1X sampling – mornings:

$$\begin{aligned} \text{ECM_kg/24h} = & \text{Parity_group} * \text{DIM_group} + \\ & \beta_1 \text{ morning_fat_kg} * \text{PD} + \\ & \beta_2 \text{ morning_milk} * \text{PD} + \\ & \beta_3 \text{ morning_prot_kg} * \text{PD} + \\ & \beta_4 \text{ evening_milk} * \text{PD} + \\ & \beta_5 \text{ milking_Interval_morning} * \text{PD} \end{aligned}$$

Reduced protocols ignore the red co-variates



Study data – Holstein herds in Denmark using full recording, but only 6X per year

- Herds, $n = 121$
- Parlor 20+ per TD, n herd-test-days = 3359
- Holstein Cows ($n = 33,374$) , parities grouped 1, 2, 3+, $n = 292,297$ milkings
- Milk Recording: Electronic meters – Tru-test
 - Time at milking
 - Yield
- Milk samples, Eurofins / Foss
 - Fat_B, Protein (Cells)
 - ECM kg/d



Full recording = reference

- ECM Yield 24h = ECM evening + ECM morning



Protocol comparison criteria

- The accuracy of extrapolated ECM is given by the residual standard deviation = "root mean square error RMSE" (small values are good)
- The "uncertainty range", can be defined as the difference between the fractiles at 5% and 95% - a simple function of RMSE
- The ability to describe individual differences among cows – the repeatability, a coefficient between 0.0 and 1.0. (large values are good) –
 - Sets the upper limit for heritability...
 - Calculated from variance components

Common alternating: 2X recording + 1 sample

Assumption:

fat%, protein% at am/pm change similarly with milking interval in all herds

Morning

- RMSE = 1.04 kg
- Uncertainty range :
 - -1.49 to +1.63 Kg
- Repeatability, $t = 0.41$
same as for "Full" (0.42)

Evening

- RMSE = 1.15 kg,
- Uncertainty range:
 - -1.49 to +1.65 Kg
- Repeatability, $t = 0.41$
similar to "Full" and Morning

Reduction:

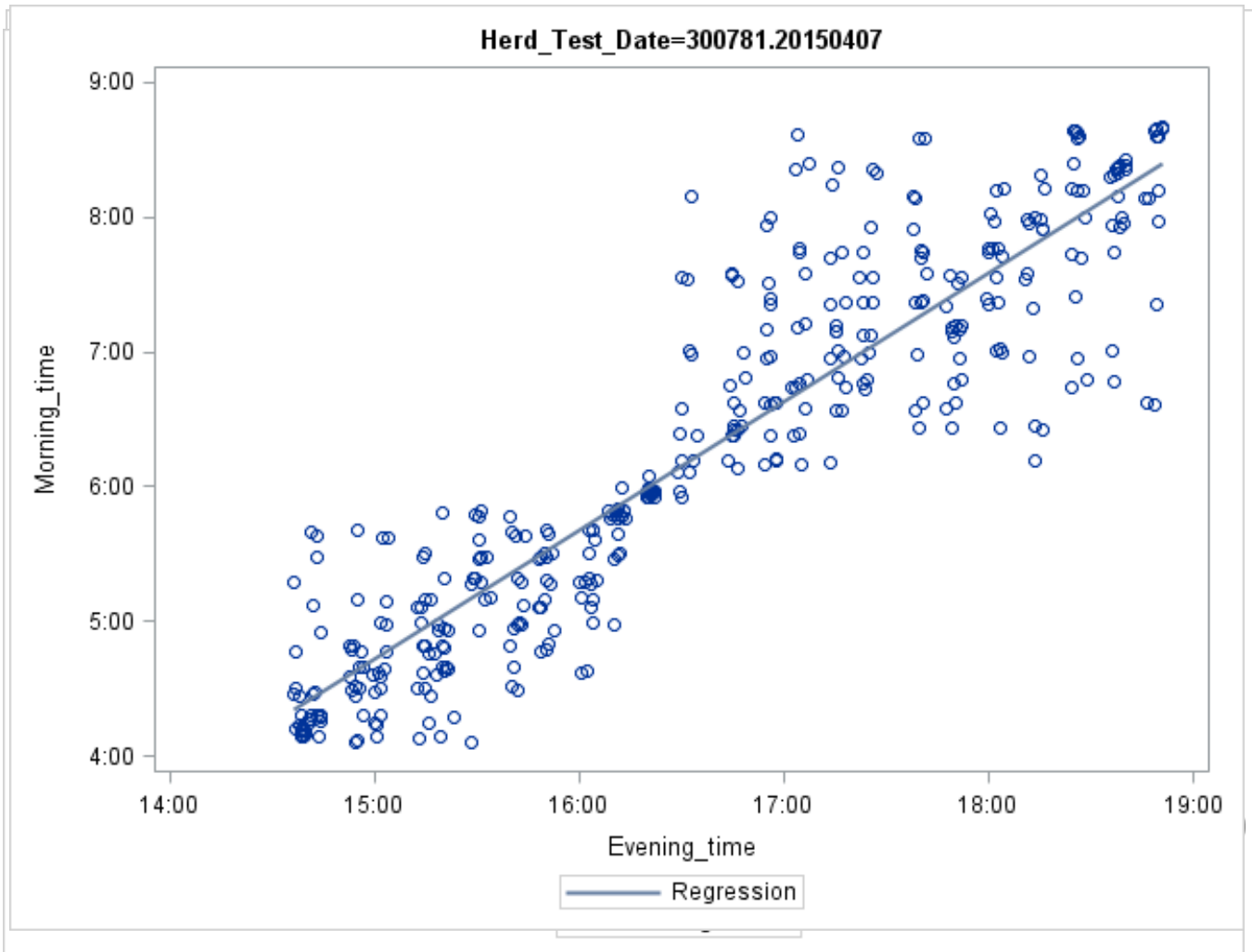
Morning recording and sample – morning interval

– now without yield from evening – but with milking interval

- RMSE = 2.32 kg – **TWICE** that of the common protocols
- Uncertainty range: -3.26 to +3.69 $\pm 11\%$
- Repeatability, $t = 0.38$, less affected ("Full" $t = 0.42$)

Could evening information be further ignored? If milking order is stable, a common interval for all cows in a herd would do it!

Milking order is not constant !
So, milking intervals also vary within test-day



Average milking interval
13:39 h

STD 0:34 h

Percentile range 5% – 95%:
12:47 to 14:45 hours

A range of 2 hours !

Similar ranges in most herds!

Reduction: 1X recording / 1X sample - morning

With common milking interval

- RMSE= 2.41 kg
- Uncertainty range
-3.52 to 3.82 ~ 13%
- Repeatability = 0.32

Ignored milking interval

- RMSE = 2.52 kg
- Uncertainty range
- 3.74 to to 4.05 ~ 13%
- Repeatability = 0.30

Both protocols perform somewhat worse than the one having individual milking interval

Summary and Conclusions

- Reduced recording and sampling is already implemented
- "error" on each test day record increase with reduced intensity

Intended use?

Decision support at cow level: **Need for very high accuracy**

Breeding: Less accurate may be compensated by large numbers of cows

Take home:

Less work → Less recording → Less samples – Less accurate

Thanks – questions please ...
Gracias – cuestiones ...

