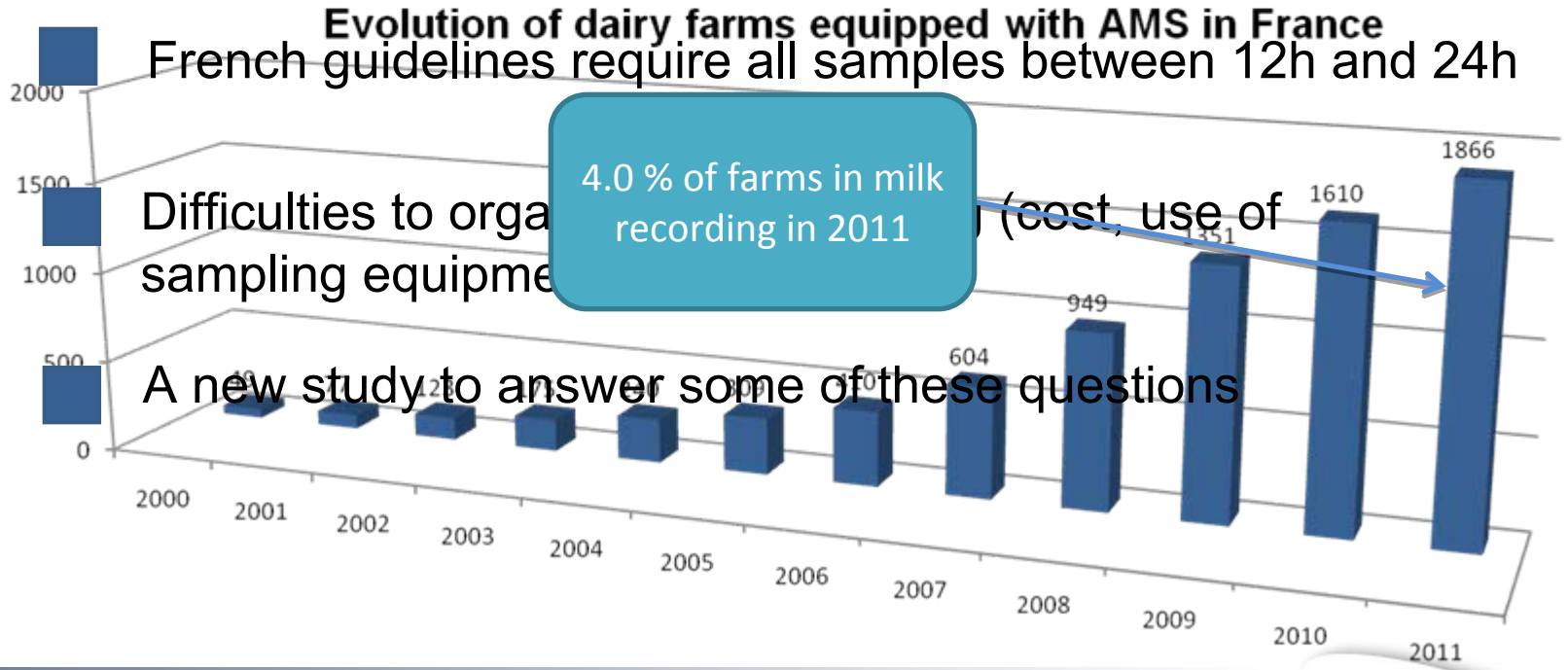
Analysis of the accuracy of protocols in robotic milking herds for estimation of 24-hour fat and protein (yields and percentage)

H.Leclerc, B.Huquet, S.Minery, X.Bourrigan, G.Thomas & D.Saunier

Introduction

- Development of the number of farms equipped with robots (in France, Europe,…)
- French guidelines require all samples between 12h and 24h
- Difficulties to orga… (cost, use of sampling equipme…
- A new study to answer some of these questions



4.0 % of farms in milk recording in 2011

Aims of the study

- Evaluate the impact of a sample number limitation
- Evaluate the effect of the sampling period reduction
- Evaluate the possibilities of adjusting sampling for specific covariates to improve results (fat yields and %)

→ 6 protocols have been tested

Description of protocols

- P1* : uses one sample
- P2* : uses two samples
- P3* : uses all samples for which milk intervals ≤ 8 hours
- P4* : uses all samples for which milk intervals ≤ 10 hours
- P5* : uses all samples for which milk intervals ≤ 12 hours
- P6 : uses single sample adjusted for covariates

* With P1 to P5 all samples are unadjusted for covariates

Description of the two datasets

	Dataset for P1 to P5	Dataset for P6
# Test-day records selected for analysis	52 314	24 628
# Cows	19 783	7 624
# Herds	268	109
# Samples per cow	1.88	2.38
Average length of sampling period	19:03	21:18

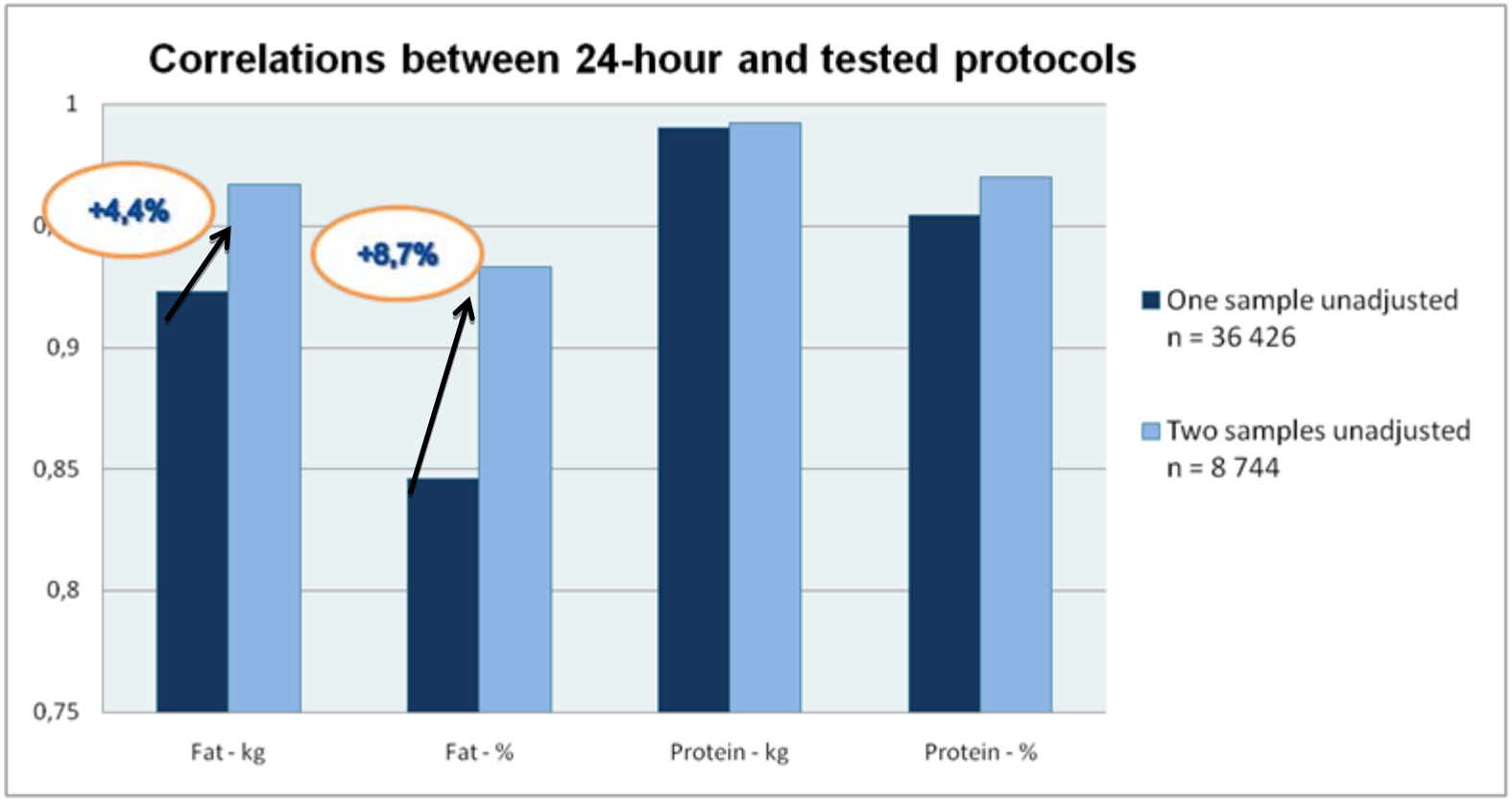
It is not possible to compare results obtained from P1-P5 with the ones from P6 where additional information were required

Description of 24h performance

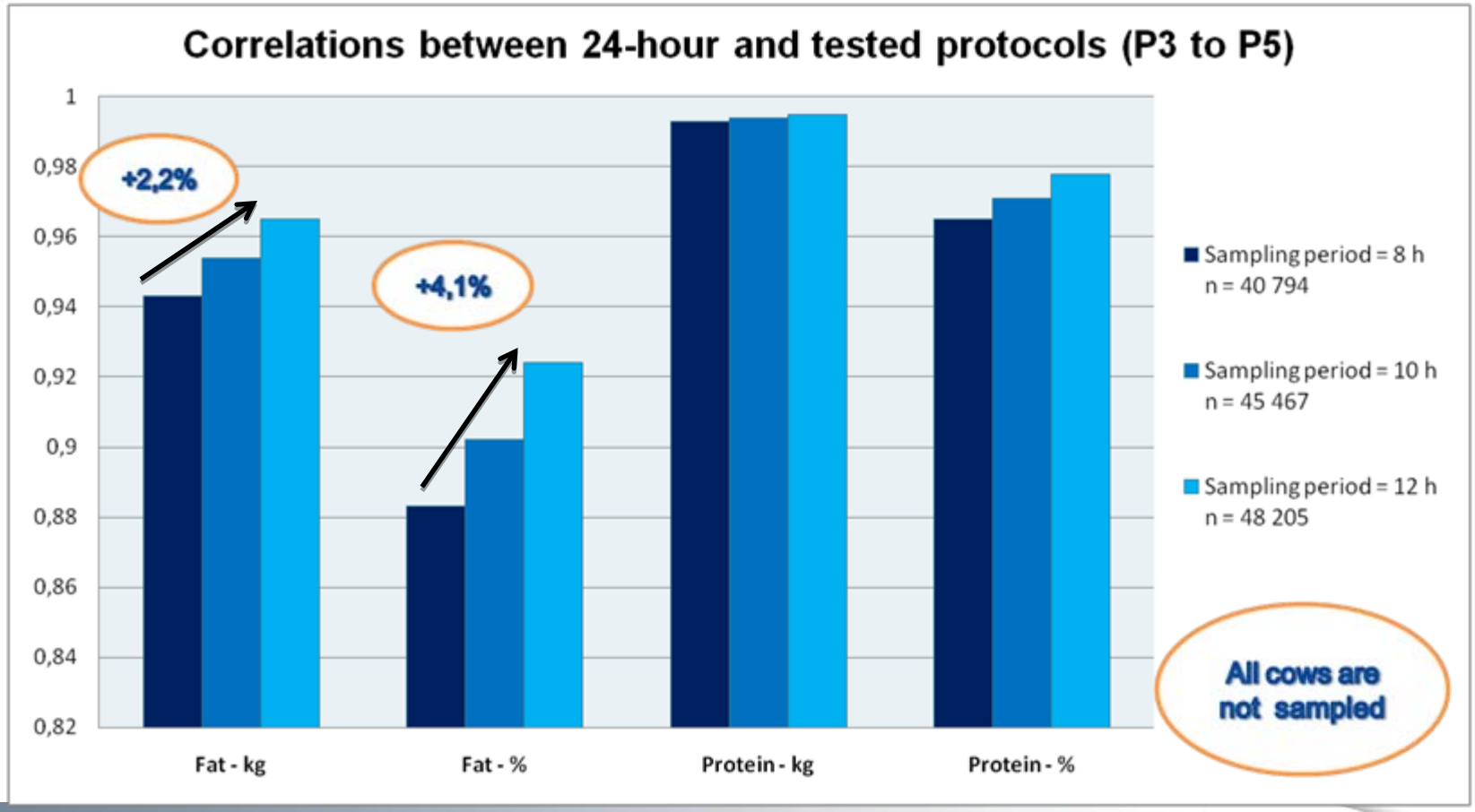
Traits	Dataset for P1 to P5		Dataset for P6	
	Mean	Standard Deviation	Mean	Standard Deviation
Milk - kg	26.9	9.12	30.2	8.50
Fat - kg	1.084	0.350	1.182	0.320
Protein - kg	0.873	0.260	0.961	0.238
Fat - %	4.125	0.791	3.991	0.692
Protein - %	3.305	0.390	3.229	0.332

The two datasets shows “classical” performance

Limitation of sample number to one (P1) or two (P2)



Effect of sampling period (8h=P3, 10h=P4, 12h=P5)



Analysis of results

With only one sample (P1)

- Fat yields and % are deeply impacted
- The impact is limited for protein yields and %

With at least two samples (P2)

- Correlations are higher for protein yields and % (and also fat yields)
- Only fat % is affected (correlations = 0.93)

With a reduction of sampling period : 8 hours (P3) - 12 h (P5)

- Correlations decrease for all traits
- All cows are not sampled (between 22% for P3 to 8% for P5)

Description of P6

Regression model of P6

$$y_{24\text{-}h\ \text{estimated}}^{[ijkl]} = b_0^{[ijkl]} + b_1^{[ijkl]}\, y_{1sample}^{[ijkl]} + b_2^{[ijkl]}\, milk_{24\text{-}h}^{[ijkl]}$$

Definition of classes considered in P6

covariates	Number of classes	Classes definition
i = Parity	2	1st lactation, 2nd and later
j = Milking intervals	5	< 6 h ; 6 h - 8 h ; 8 h - 10 h ; 10 h - 12h ; > 12 h
k = Lactation stage	12	30 days per class
l = am / pm (time of sampled milking)	2	3 am to 3 pm / 3 pm to 3 am

Results for one sample adjusted for covariates (P6)

- Correlations between 24-hour and single sample adjusted according parity and time of sampled milking

		L1		L2+	
Traits	**Adjustment**	**am**	**pm**	**am**	**pm**
Number of samples records		10 119	11 587	17 058	19 298
Fat - kg	*No*	*0.874*	*0.871*	*0.875*	*0.878*
	Yes	**0.913**	**0.907**	**0.920**	**0.914**
Fat - %	*No*	*0.804*	*0.795*	*0,785*	*0.772*
	Yes	**0.840**	**0.832**	**0.822**	**0.810**

- **Adjustment improves correlations for Fat % and yields around 0.04**
- **No large differences according to parity and time of sampled milking**

Results for one sample adjusted for covariates (P6)

Correlations between 24-hour and single sample adjusted according parity and time of sampled milking

Traits	Adjustment	L1		L2+	
		am	pm	am	pm
Number of samples records		10 119	11 587	17 058	19 298
Protein - kg	*No*	*0.981*	*0.979*	*0.981*	*0.979*
	Yes	**0.985**	**0.983**	**0.984**	**0.983**
Protein - %	*No*	*0.909*	*0.896*	*0.913*	*0.903*
	Yes	**0.920**	**0.909**	**0.922**	**0.915**

- **For Protein yields and %, adjustment is negligible (max 0.01)**
- **No large differences according to parity and time of sampled milking**

Results for one sample adjusted for covariates (P6)

- Correlations between 24-hour and single sample adjusted according to milk intervals with previous milking

Traits	Adjustment	Milking intervals				
		< 6 h	6 - 8 h	8 - 10 h	10 - 12 h	> 12 h
Number of samples records		4 965	16 016	15 910	10 320	10851
Fat - kg	*No*	*0.821*	*0.872*	*0.875*	*0.880*	*0.900*
	Yes	**0.879**	**0.910**	**0.918**	**0.923**	**0.930**
Fat - %	*No*	*0.704*	*0.786*	*0.805*	*0.813*	*0.837*
	Yes	**0.750**	**0.807**	**0.825**	**0.829**	**0.847**

- **Large impact of intervals with previous milking on correlations**
- **Adjustment improves correlations between 0.03 to 0.06 for Fat yields but only 0.01 to 0.05 for Fat %**

Results for one sample adjusted for covariates (P6)

- Correlations between 24-hour and single sample adjusted according to milk intervals with previous milking

Traits	Adjustment	Milking intervals				
		< 6 h	6 - 8 h	8 - 10 h	10 - 12 h	> 12 h
Number of samples records		4 965	16 016	15 910	10 320	10851
Protein - kg	*No*	*0.966*	*0.974*	*0.978*	*0.981*	*0.986*
	Yes	**0.977**	**0.980**	**0.983**	**0.985**	**0.989**
Protein - %	*No*	*0.855*	*0.889*	*0.899*	*0.904*	*0.927*
	Yes	**0.880**	**0.902**	**0.912**	**0.915**	**0.934**

- **Low impact of intervals for protein yields, larger for protein %**
- **Adjustment is negligible for protein yields (max 0.01) - higher for protein % (between 0.01 and 0.025)**

Summary of P6 analysis

- **Without adjustments, fat % and yields are not very well predicted**
- **Adjustments enable to improve correlations**
  - fat yields and %
  - but correlations are not high at least for fat % in some particular cases (0.75 when milking interval is lower than 6 hours)
  - impact is limited for protein yields
  - for protein %, adjustment is interesting when milking intervals is lower than 6 hours
- **Effects of parity and time of sampled are limited**
- **The impact of milking intervals is high for all traits especially when the interval is lower than 6 hours**

Conclusion

- **This French study shows that :**
  - a restriction to a single sample undajusted has a large impact on the accuracy (fat % and yields)
  - a reduction of sampling period to less than 12 hours has an impact (fat %, all cows are not sampled)
  - a protocol with at least two sampled milking gives interesting results
  - adjustment for a single sampled milking needs to be carefully analysed
- **It's important to compare results with other references**
- **Before adopting any protocols for genetic evaluation, it's imperative to ensure they are unbiased and reliable !!!**

Thank you for your attention