Technical Session 4: Future Daily Yield Calculations for Cattle

Analysis of the accuracy of C method for estimating 24-hour yields with alternated protocols

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Context and aims of this French study

➢ The context

- 25% of dairy herds use alternated protocols (T or Z)
- Breeders wish to reduce the cost of milk recording

➢ The aims

- Study an ICAR method with constant one-milking recording (C)
- Evaluate the accuracy from relevant data sets
- Update the accuracy of T method
- Use the Liu's method for estimating 24-hour yields
- Compare the results with those obtained by other countries

ICAR Guidelines in alternated protocols

- **Alternated one-milking recording (T)**
  - Samples and milk weights are taken during one milking, *alternating between morning and evening milkings*
- **Constant one-milking recording (C)**
  - Samples and milk weights are taken during one milking, *constantly during morning or evening milkings*
- **One-milking sampling with milk weights from more than one milking (Z)**
  - Samples are taken from one milking during the recording day, *while milk weights are taken at each milking or over several days*

Description of the data sets

- First data set on test-day records
  - 208 000 test-day records, 150 herds, 14 000 cows
- Second data set on lactation
  - 19 000 lactations with reference 305 days
- Performance 305 days
  - High level of milk yields

Criteria - 305 days	Mean	St. Devi. (SD)	Min	Max
Milk yields - kg	9 172	1 829	2 359	17 953
Fat - %	3,85	0,46	1,99	5,93
Fat yields - kg	351	71	88	640
Protein - %	3,12	0,21	2,39	4,39
Protein yields - kg	285	54	70	518

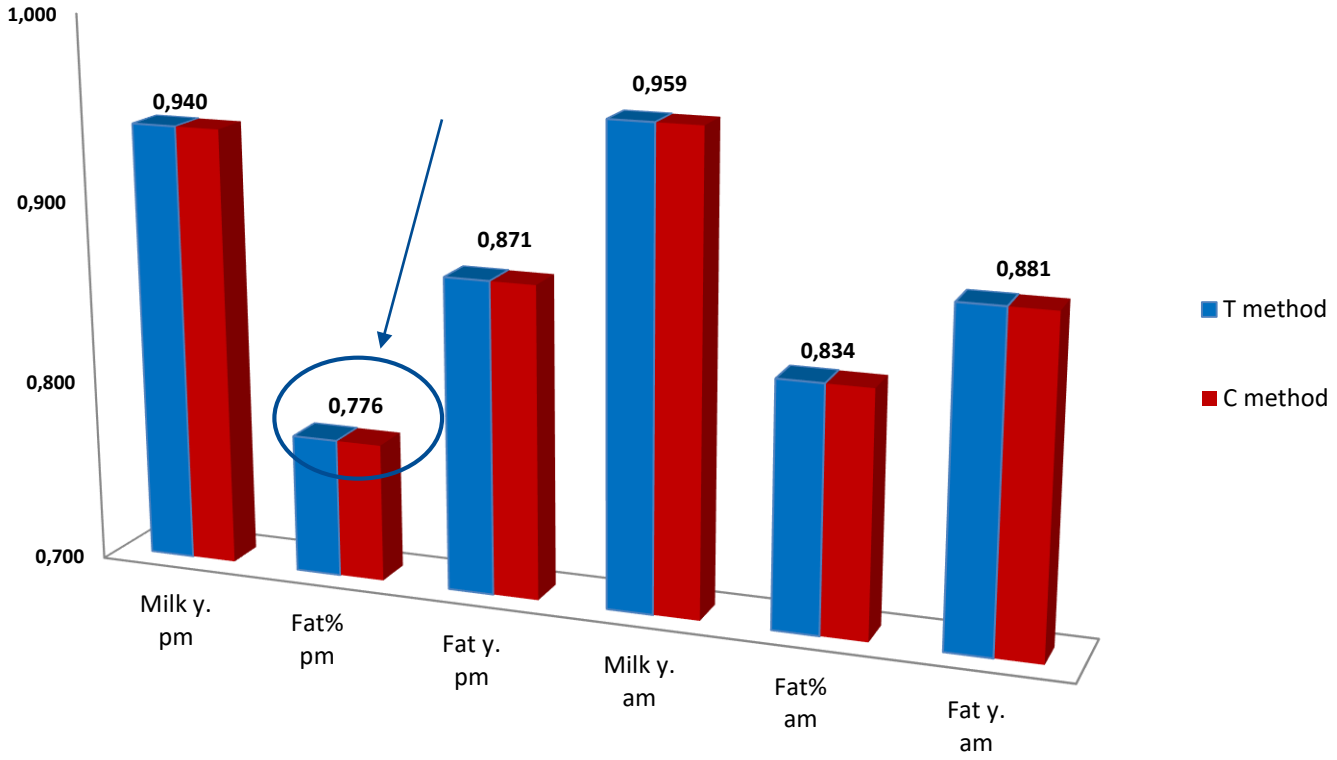
Statistical method

- **Update of Liu's method regression formula**
  - Defined in 2011, recalculated and checked in 2015
  - Splitted the data set an estimation sample and validation sample
- **Comparisons carried out**
  - C and T methods pm and am milking / Reference 24 hour
  - C method all pm milking, all am milking / Reference 305 days
  - T method pm-am milking, am-pm milking / Reference 305 days
  - On criteria: milk, fat, protein
- **Criteria statistical**
  - Mean bias, standard deviation of bias, correlations, R^2

What are the results of accuracy on test-day record?

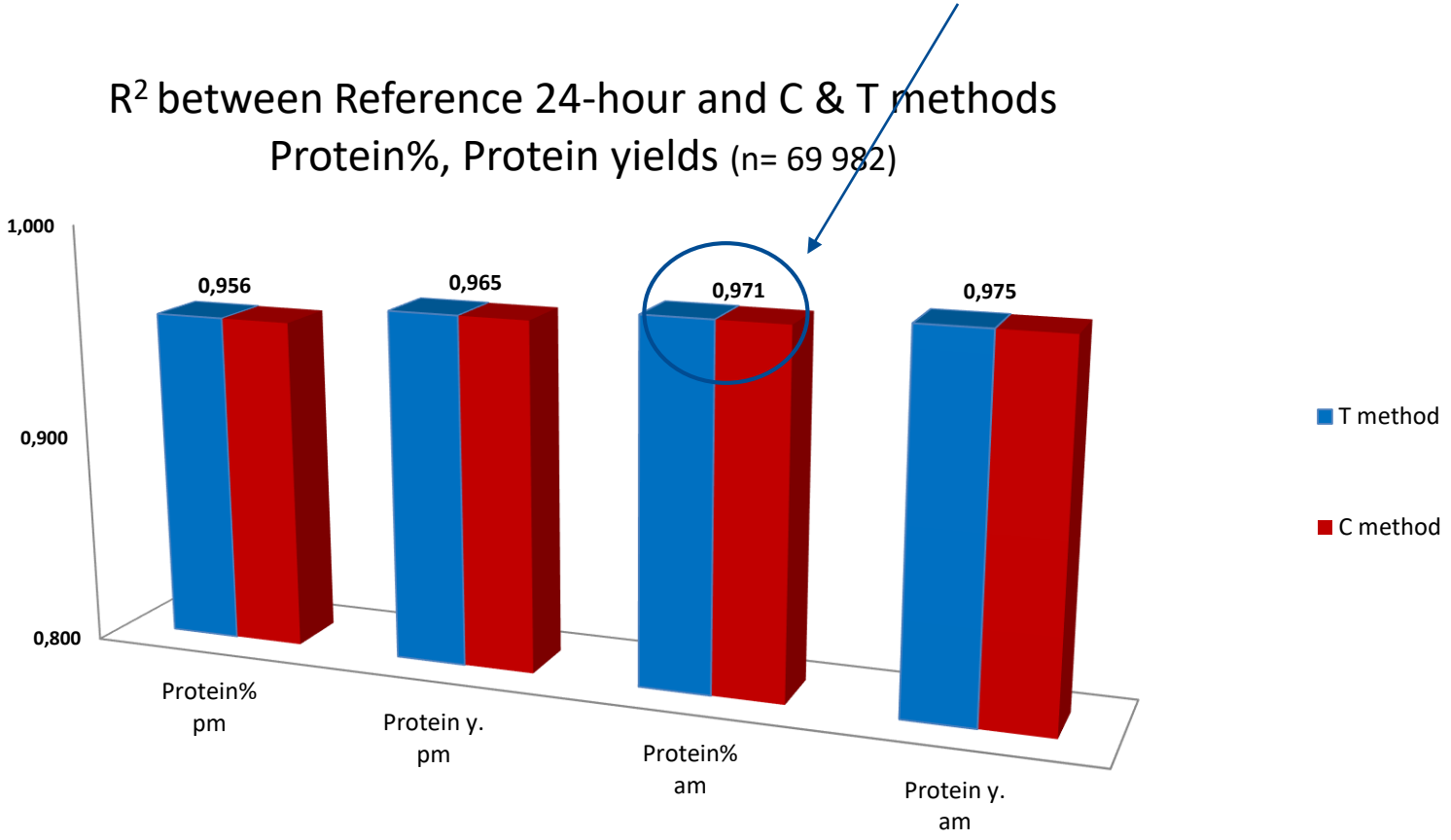
Results of R^2 on test-day record

R^2 between Reference 24-hour and C & T methods
Milk yields, Fat%, Fat yields (n= 69 982)



Better level of R^2 on morning milking for all criteria
Lower results for fat% mainly on evening milking

Results of R^2 on test-day record



High level of R^2 for protein% and protein yields
Better accuracy R^2 on morning milking

Results of bias, standard deviation on test-day record

Estimated method / Reference 24-hour n=69 982 test-day		Mean bias	Stan. Devia. of bias
C and T methods *Milk yields - kg*	*Pm milking*	*0,0*	*2,0*
	Am milking	*0,0*	*1,6*
C and T methods *Fat - %*	*Pm milking*	*0,00*	*0,32*
	Am milking	*0,00*	*0,28*
C and T methods *Fat yields - kg*	*Pm milking*	*0,0*	*0,1*
	Am milking	*0,0*	*0,1*

Mean bias equal to 0
Better level of Stan. Devia. on morning milking

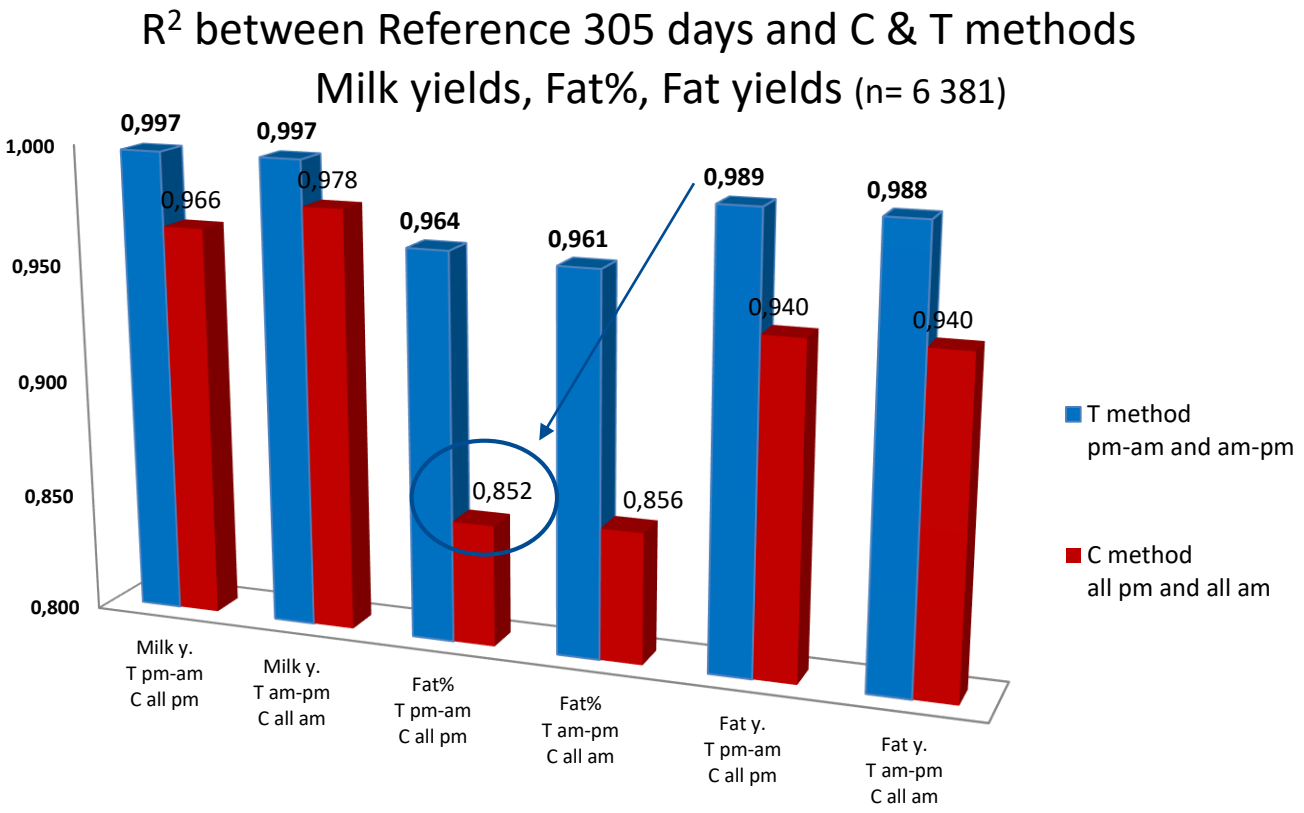
Results of bias, standard deviation on test-day record

Estimated method / Reference 24-hour n=69 982 test-day		Mean bias	Stan. Devia. of bias
C and T methods *Protein - %*	*Pm milking*	*0,00*	*0,07*
	Am milking	*0,00*	*0,06*
C and T methods *Protein yields - kg*	*Pm milking*	*0,0*	*0,0*
	Am milking	*0,0*	*0,0*

Mean bias equal to 0
Better level of Stan. Devia. on morning milking for protein%

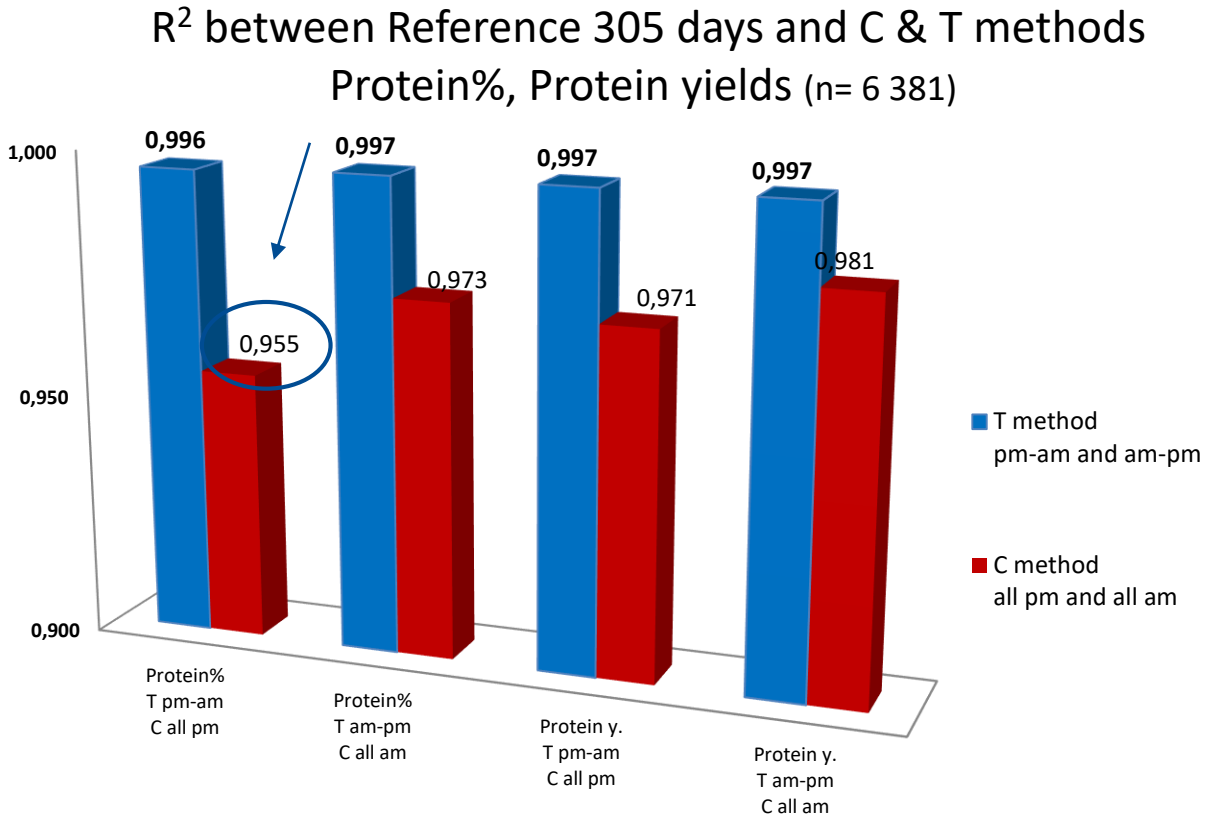
What are the results of accuracy on 305 lactation days?

Results of R^2 on lactation



Lower level of R^2 on C method for all criteria
Lost of accuracy = 15% for fat% on evening, morning milkings

Results of R^2 on lactation



High level of R^2 on C method for all criteria
Greater than 0,955 on all evening milking

Results of bias, standard deviation on lactation

Estimated method / Reference 305-days n=6 381 lactations		Mean bias	Stan. Devia. of bias
T method *Milk yields - kg*	*Pm-am milking*	*11*	*155*
	Am-pm milking	*11*	*152*
C method *Milk yields - kg*	*All pm milking*	*0,5*	*353*
	All am milking	*21*	*263*
T method *Fat - %*	*Pm-am milking*	*0,009*	*0,10*
	Am-pm milking	*0,009*	*0,10*
C method *Fat - %*	*All pm milking*	*0,004*	*0,18*
	All am milking	*0,018*	*0,18*

Some differences on mean bias between C & T methods
Lower results of Stan. Devia. with C method

Results of bias, standard deviation on lactation

Estimated method / Reference 305-days n=6 381 lactations		Mean bias	Stan. Devia. of bias
T method *Fat yields - kg*	*Pm-am milking*	*0,9*	*12,0*
	Am-pm milking	*0,8*	*12,2*
C method *Fat yields - kg*	*All pm milking*	*0,6*	*18,4*
	All am milking	*1,1*	*18,4*
T method *Protein yields - kg*	*Pm-am milking*	*0,4*	*4,3*
	Am-pm milking	*0,4*	*4,3*
C method *Protein yields - kg*	*All pm milking*	*0,3*	*9,6*
	All am milking	*0,5*	*7,5*

Overall same results on mean bias
Lower results of Stan. Devia. with C method

What are the results of accuracy of another study?

Presentation of this study

- Study of Berry and al, 2005
  - Collaboration Moorepark Ireland and Wageningen Netherlands
  - From 42 000 test-day records, 700 cows Holstein breed
  - Performance: Milk yields 6 000 kg, Fat y. 225 kg, Protein y. 200 kg
  - Use of Multiple Regression Model to estimate 24 hour yields
  - A4 the reference method
- Accuracy calculated on 305 lactation days
  - C method all pm milking, all am milking / Reference 305 days
  - For Milk yields, Fat yields, Protein yields

Comparison between the French study and Berry's study

Estimated method / Reference 305-days Milk, Fat, Protein yields		*Accuracy R^2 French study*	Accuracy R^2 Berry study
Estimated C method	Milk yields - All pm	*0,966*	0,930
	Milk yields - All am	*0,978*	0,960
	Fat yields - All pm	*0,940*	>0,910
	Fat yields - All am	*0,940*	>0,910
	Protein yields - All pm	*0,971*	>0,950
	Protein yields - All am	*0,981*	>0,950

Overall better level of R^2 with C method in the French study for all criteria

Comparison between the French study and Berry's study

Estimated method / Reference 305-days		*Mean bias French St.*	Mean bias Berry St.	*SD of bias French St.*	SD of bias Berry St.
Estimated C method	Fat yields All pm	*0,5 kg*	-0,4 kg	*18,3 kg*	19,4 kg
	Fat yields All am	*1,1 kg*	1,0 kg	*18,4 kg*	17,8 kg
Estimated C method	Protein yields All pm	*0,2 kg*	-0,1 kg	*9,6 kg*	12,0 kg
	Protein yields All am	*0,4 kg*	0,4 kg	*7,4 kg*	9,3 kg

Overall same level of mean bias with both studies
Some differences for Stan. Devia. for protein

Conclusion - Discussion

Reminder of questions asked in the study:

- **What's the accuracy of C method on test-day?**
  - Equal to T method for milk, fat, protein
  - Better results on morning milking
- **What's the accuracy of C method on lactation?**
  - The lost of accuracy = 15% for fat% and = 6% for fat yields
  - Respectively = 4% for fat% and = 1% for fat yields with T method
  - Results of accuracy worse with C method for all criteria
- **What are the results compared with another study?**
  - Overall the results are the same
  - Level of performance 305 days different between both studies

Conclusion - Discussion

Consequences of the study:

- **Proposals of FGE by the end of 2019**
  - Integrate C method in the French Milk Recording Guidelines
  - With conditions:
    - *Use Liu's method for estimating 24-hour*
    - *Define ponderations applied for genetic evaluation among the level of lactation qualification*
  - Continue the study for other criteria: SCC, Urea, BHB
- **Exchange with other organisations**
  - 5 organisations use C method (result of last ICAR survey 24-hour)
- **Improve the level of accuracy**
  - By testing new Liu's method presented during this conference

Thank you for your attention