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Adding Value to Test-Day Data by Using Modified Best Prediction Method

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Context

- Lactation yields computation
  - Genetic evaluations
    - Lactation models ⟶ Test-day models
  - Management purpose
    - Farms are getting larger
    - Economic sustainability

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Context

- Lactation yields computation methods
  - Official method (ICAR)
    - Test Interval Method (TIM)
  - Other methods approved by ICAR
    - Interpolation using standard lactation curves
    - Best Prediction (BP)
    - Multiple Trait Prediction (MTP)

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Context

- Lactation yields computation methods
  - Test-day model
    - Mayeres *et al.* (2004)
    - Vasconcelos *et al.* (2004)
  - Mayeres *et al.* (2004)
    - Herd x Test-day (Fixed) ⟶ Herd x Year (Fixed)
      Herd x Month (Fixed)
      HTD (Random)
    - Sum of all effects (except HTD) = daily yield
    - Sum of daily yields = lactation yield

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General Objective

- Develop a new lactation yields computation method which
  - brings useful management tools
  - is robust with milk recording plans other than classical A4

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Method

- Random regression test-day model
- Multi lactation
  - 1, 2, and 3 and more
- Multi trait
  - Milk (kg), fat content (kg and %), protein content (kg and %)
  - Somatic cell score

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Method

- Standard lactation curves account for
  - Year of production within herd
  - Season of production within herd and within 5 year period
  - Parity x breed x age at calving
  - Year of calving within herd
  - Genetic value of the cow

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Method

- "Herd level" standard lactation curves components computed jointly with random effects
- Precorrection for "population level" standard lactation curves components
- Bayesian prediction
  - Sum of residuals = 0 per animal x lactation

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Method

- Test-day model equivalent to selection index
- Similar to Best Prediction
  → Modified Best Prediction (mBP)
- Main differences
  - Genetic value
  - Some components of standard lactation curve estimated jointly

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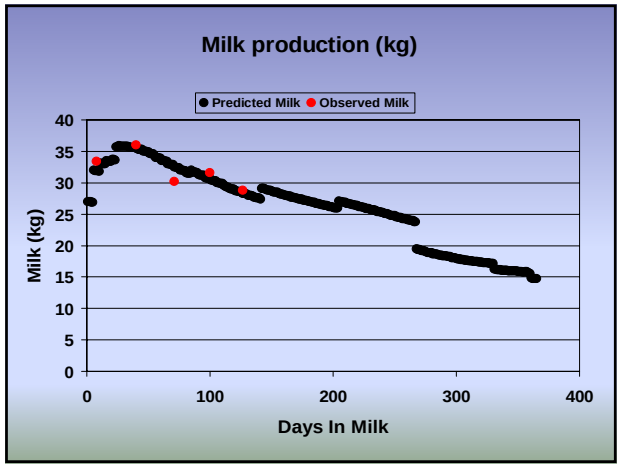

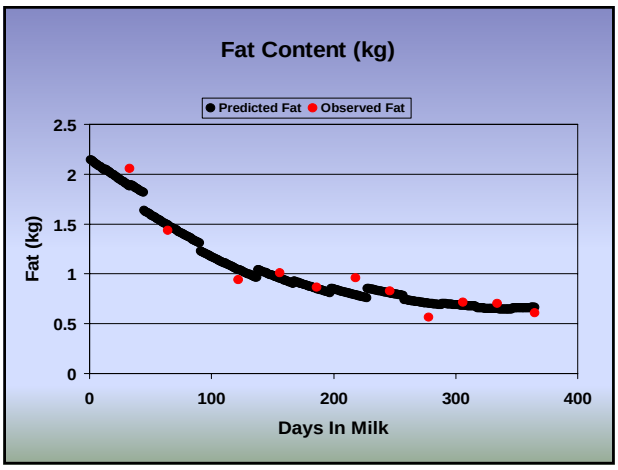

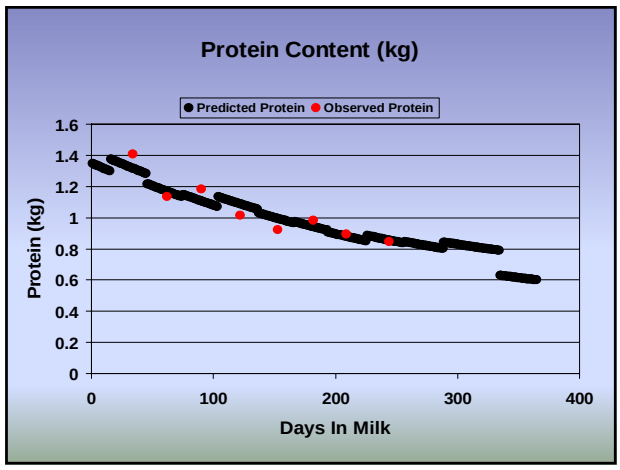

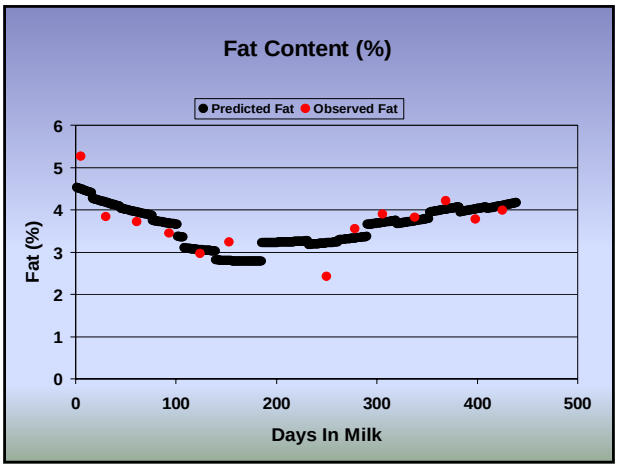

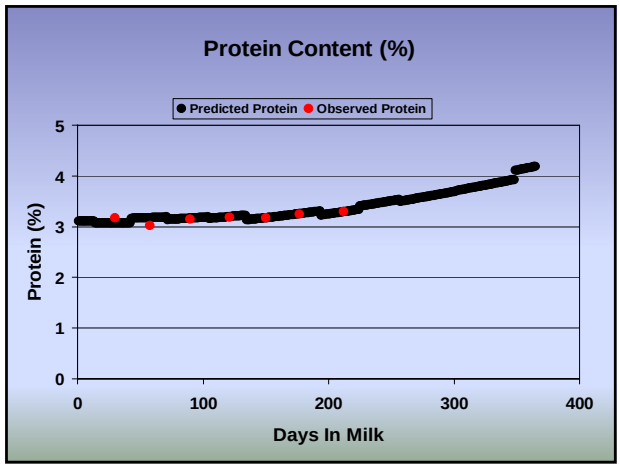

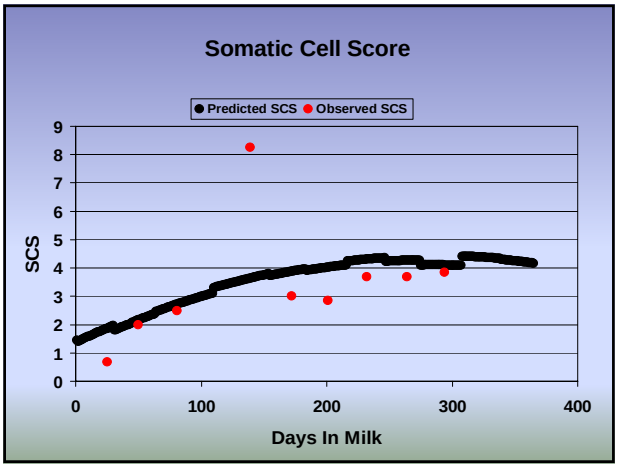

Management tools

- 305-d (or 365-d) lactation yield prediction
- Alert if production is different than predicted
  - Bastin *et al.* (2008) : BCS modelling
  - Bastin *et al.* (2009) : milk urea modelling
- Evolution of the herd level

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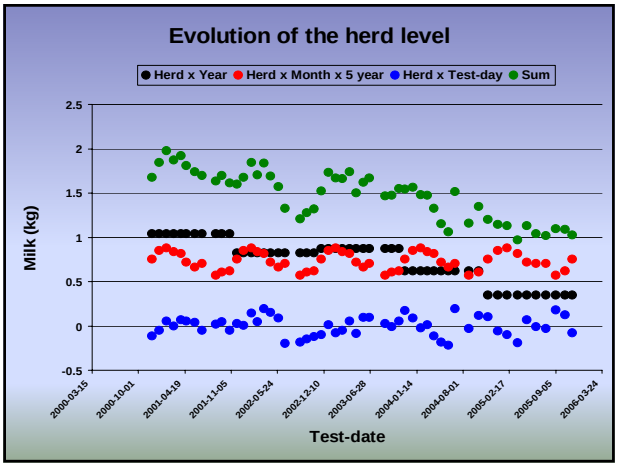

Validation on test-day data

- Adjustment quality and prediction ability

Parity 1	Adjustment Quality (n = 98,578)			Prediction Ability (n = 1,001)		
Trait	ME[1]	MSE[2]	Corr.[3]	ME[1]	MSE[2]	Corr.[3]
Milk (kg)	0.00	3.26	.96	0.41	12.5	.83
Fat (kg)	0.00	0.00	.94	0.01	0.02	.77
Prot (kg)	0.00	0.00	.95	0.01	0.01	.79
Fat (%)	0.00	0.01	.89	0.00	0.27	.66
Prot (%)	0.00	0.02	.94	0.00	0.05	.77
SCS	0.00	0.71	.85	-0.27	1.67	.61

[1]ME : Mean Error
[2]MSE : Mean Square Error
[3]Corr. : Correlation between observation and prediction

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Validation on lactation yields

- Daily production data collected in the field
  - 4 herds – 312 cows – 562 lactations – 132,607 daily productions
- Simulation of test-day records
  - Respect of schedule of conditions and characteristics of Walloon Region of Belgium
  - Comparison of real lactation yields with mBP, BP, and TIM
  - BP not possible ⟶ BP-like

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305-d lactation yields description

	n	mBP		BP-like		TIM	
		rel. bias[1]	corr.[2]	rel. bias[1]	corr.[2]	rel. bias[1]	corr.[2]
General							
ALL	57,673	0.35	.99	-0.49	.99	0.49	.99
by data collection plan							
A4	49,137	0.36	.99	-0.44	.99	0.47	.99
A6	8,536	0.36	.99	-0.78	.99	0.60	.99
by production level (kg milk/day)							
15-20	4,402	0.83	.93	1.17	.93	0.64	.92
20-25	13,001	0.53	.94	0.06	.95	0.47	.94
25-30	18,438	0.52	.98	-0.29	.98	0.52	.98
30-35	13,501	0.17	.98	-0.78	.98	0.44	.98
35-40	8,062	0.06	.99	-1.49	.99	0.52	.99

[1]Relative bias (%) = (mean – real mean)*100 / real mean
[2]Corr. : Correlation between real and predicted lactation yields

305-d lactation yields prediction

No. records available	n	mBP		BP-like		TIM	
		rel. bias[1]	corr.[2]	rel. bias[1]	corr.[2]	rel. bias[1]	corr.[2]
1	3,800	-4.40	.81	-6.22	.85	-	-
2	6,815	-0.40	.89	-1.26	.91	-	-
3	7,659	0.82	.92	1.49	.93	-	-
4	7,961	1.02	.95	2.43	.95	-	-
5	9,048	0.75	.97	2.11	.97	-	-
6	8,783	0.26	.98	1.54	.97	-	-
7	8,734	0.24	.98	1.04	.98	-	-
8	7,933	-0.12	.99	0.29	.99	-	-
9	6,835	-0.09	.99	-0.15	.99	-	-
10	5,253	-0.04	.99	-0.38	.99	-	-
11	3,459	-0.21	.99	-0.91	.99	-	-

[1]Relative bias (%) = (mean – real mean)*100 / real mean
[2]Corr. : Correlation between real and predicted lactation yields

Conclusions & Perspectives

- Test-day model is a well-adapted method to describe lactation curve
- Interesting management tools
  - Prediction of future production
  - Alerts
  - Evolution of herd level
- Compare with official Best Prediction

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Thank you for your attention

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