Dedicated Analytical Solutions

GLOBAL EXPERIENCE ON KETOSIS SCREENING BY FTIR TECHNOLOGY

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1 FOSS Denmark
2 valacta Canada
3 Qlip The Netherlands
4 Closel conseils et services en élevage France
5 CRV The Netherlands

ICAR Technical Workshop, 10 June 2015

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KETOSIS – THE HIDDEN DISEASE

- Ketosis is a frequently occurring metabolic disease
  - Mainly occurring in the early lactation – severe negative energy balance (NEB)
  - Mobilisation of body fat to compensate NEB → ketone bodies (i.e. acetone (Ac), β-hydroxybutyrate (BHB)) originate and accumulate
  - Major impact on future production, reproduction and overall health of the cow **(e.g., Opsina *et al.*, 2010; Duffield *et al.*, 2009)**
  - Cost per case of ketosis: 265€ **(Mc Art *et al.*, 2015)**

- Diagnosis of subclinical ketosis:
  - No visible symptoms – need for measurement of ketone bodies in blood, milk, or urine **(Andersson, 1988)**
  - On-farm solutions: electronic hand-held blood BHB meters; high accuracy but labour-intensive **(Iwersen *et al.*, 2009)**

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SCREENING FOR SUBCLINICAL KETOSIS ON DHI SAMPLES

1999
- Fourier Transformed InfraRed (FTIR): Fast and inexpensive method for ketosis screening by predicting milk Ac **(Hansen, 1999)**

2006
- Joint project of CRV, FOSS and Qlip; development of milk Ac and BHB predictions; appropriate for herd level screening **(de Roos *et al.*, 2007)**

Ketosis screening service on DHI samples:

2011
- Qlip, CRV and MCC Flanders, the Netherlands and Belgium;
- Valacta, Canada

2012
- CLASEL, France

2013
- Polish Breeders Association, Poland;
- Eurofins and Danish Cattle Federation, Denmark;
- Tokachi DHI, Japan

2014
- CanWest DHI, Canada

2015
- AgSource, US

Under evaluation
- DairyOne, US;
- ARAL, Italy;
- CIS, England;
- LIGAL, Spain

Milk Ac and BHB values:
- **sensitivity (69 and 87%)**
- **specificity of 95%**

(de Roos *et al.*, 2007; Denis-Robichaud *et al.*, 2014)

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KETOSIS SCREENING – DHI LABORATORY

- Instrument: Milkoscan FT+ (FTIR) with FOSS calibration for Ac and BHB

- Establishment of method:
  - 2,000 milk samples, analysis by a segmented flow analyser and FTIR to build Ac and BHB calibration
  - Further validation based on a set of 1,500 samples
  - Data processing by FOSS
- Maintenance of method:
  - Monthly analysis of 100 random samples (pilot milk) by reference method (Skalar)
  - Valacta and CLASEL: Validation of FTIR predictions
  - Qlip: no slope adjustment, no bias setting (original basic calibration established in 2006)

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DHI LABORATORY: CLASSIFICATION AND APPLICATION OF RESULTS

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ACETONE/BHB CONCENTRATION			BHB (mM/l)
RISK OF KETOSIS	**HIGH**	- Treat cow	≥0.2
	MEDIUM	- Observe cow	≥0.15-<0.20
	LOW	- No action	<0.15

As ketosis can often be a herd problem, a single alert gives the herd manager a timely warning to examine all early lactation cows.

Qlip quality assurance in agrofood

CRV

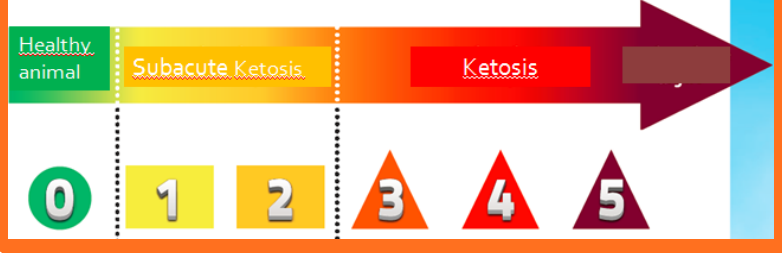
Combination of Ac and BHB values with:

- fat:protein ratio
- parity
- month of milk recording

→ binary (yes/no) score for ketosis for cows with DIM <60 only

Clasel conseils et services en élevage

Decision tree including Ac and BHB



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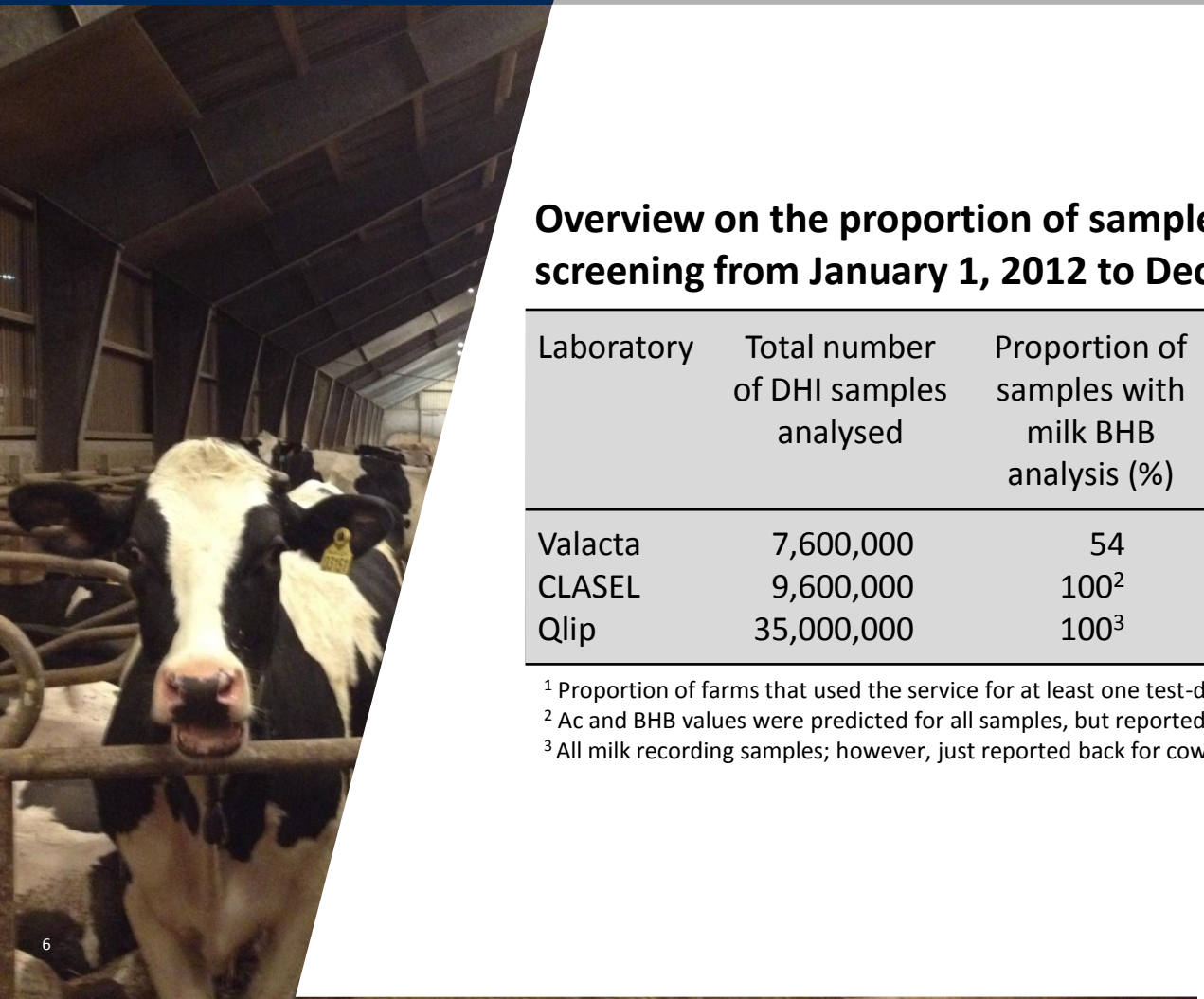
KETOSIS SCREENING IN PRACTISE



Overview on the proportion of samples, farms and cows under ketosis screening from January 1, 2012 to December 31, 2014.

Laboratory	Total number of DHI samples analysed	Proportion of samples with milk BHB analysis (%)	Proportion of farms using ketosis screening (%)	Proportion of cows under ketosis screening (%)
Valacta	7,600,000	54	71[1]	54
CLASEL	9,600,000	100[2]	48	51
Qlip	35,000,000	100[3]	85	90

[1] Proportion of farms that used the service for at least one test-day
[2] Ac and BHB values were predicted for all samples, but reported back to farms enrolled for CetoDetect® only
[3] All milk recording samples; however, just reported back for cows with days in milk<60

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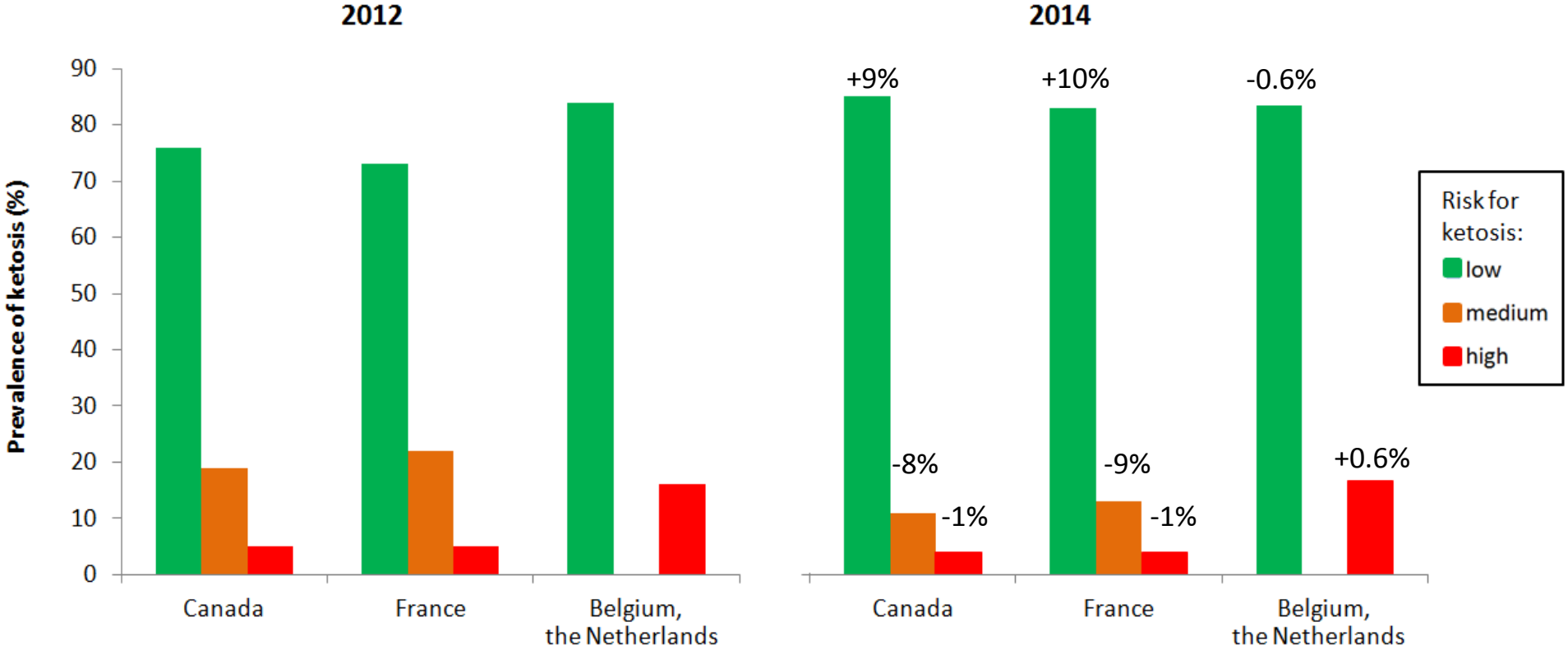
DEVELOPMENT OF KETOSIS PREVALENCE OVER TIME



Prevalence of ketosis (low, medium, high risk) in Canada (Valacta), France (CLASEL) and Belgium (region Flanders) and the Netherlands (Qlip) in 2012 and 2014, respectively. Data for Belgium and the Netherlands are expressed as ketosis yes (high risk) or no (low risk).

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REAL LIFE EXAMPLE – KETOSIS MANAGEMENT

Herd Results April 2013

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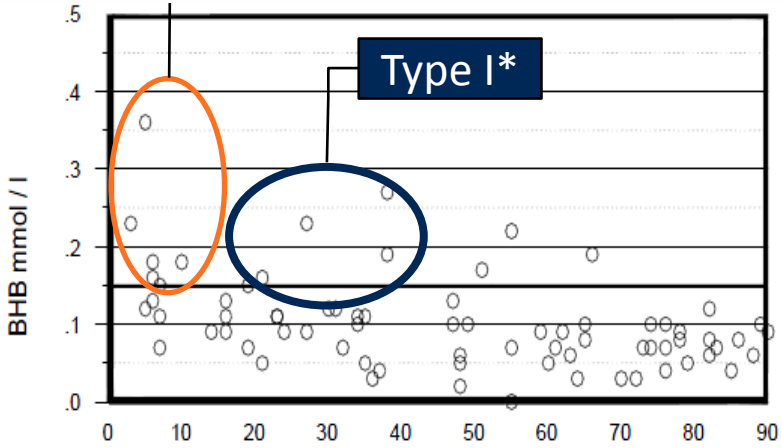
Type II**

Overview 1:

BHB values in cows with less than 90 days in milk



Advisor's suggestion: "Focus first on dry cow (far-off) rations as they obviously bring too much energy."

***Type I (**Fresh cow; Production > Dry matter intake, NEB)

****Type II (**Starts before calving; "fat cow syndrome"; insulin resistance)

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REAL LIFE EXAMPLE – KETOSIS MANAGEMENT

Herd Results December 2013 (8 month later)

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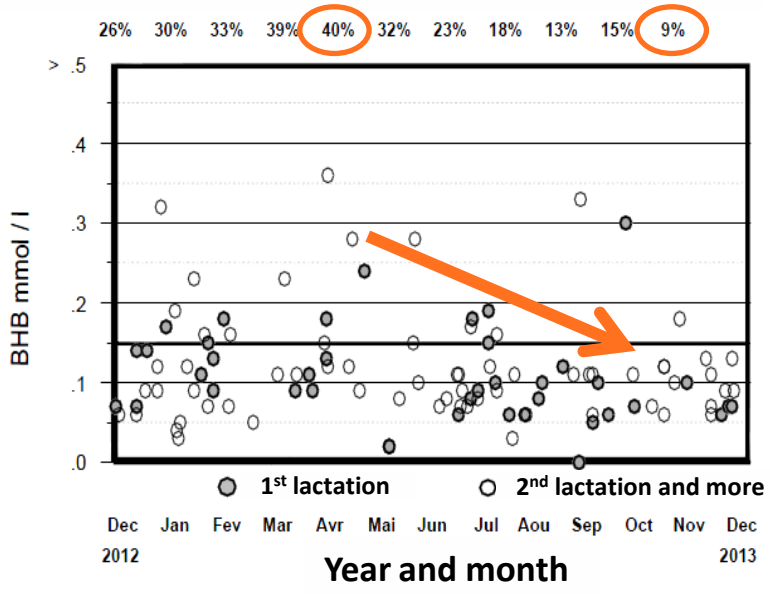
Overview 2:

BHB values at first test day over time



→Proportion of cows with high BHB decreased from 40% to less than 10%

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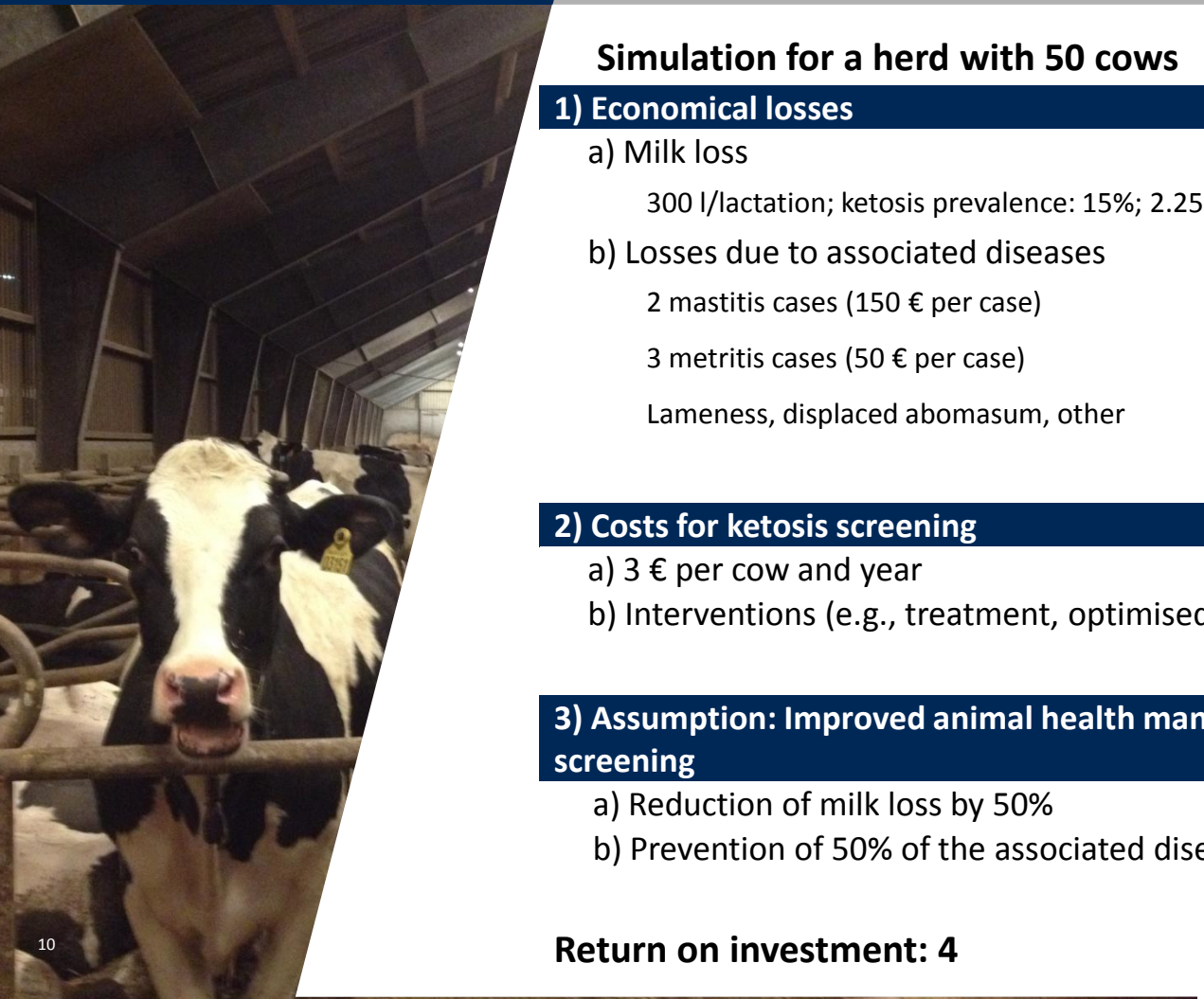
KETOSIS IMPACTS PROFITABILITY



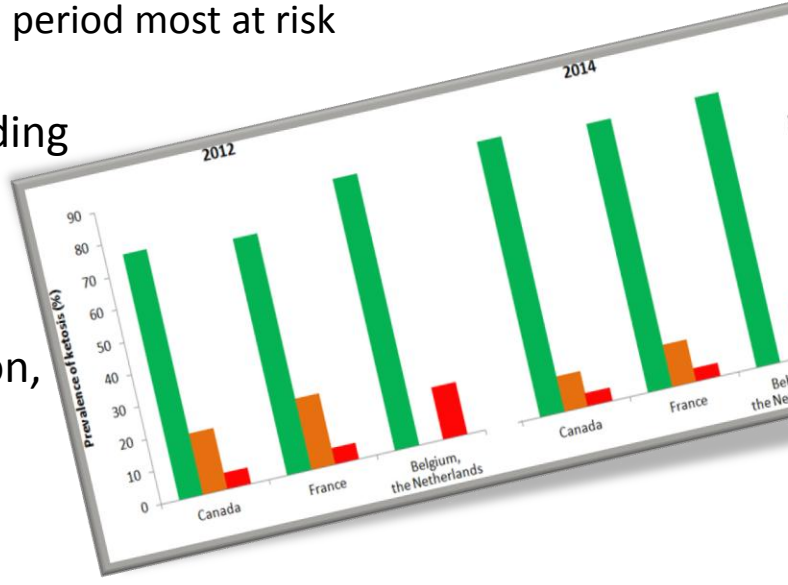
Simulation for a herd with 50 cows

1) Economical losses	
a) Milk loss	€
300 l/lactation; ketosis prevalence: 15%; 2.250 l/lactation and herd; 0.33 €/l	750
b) Losses due to associated diseases	
2 mastitis cases (150 € per case)	300
3 metritis cases (50 € per case)	150
Lameness, displaced abomasum, other	300
Total losses	1,500
2) Costs for ketosis screening	
a) 3 € per cow and year	150
b) Interventions (e.g., treatment, optimised feeding ration)	?
Total costs	150
3) Assumption: Improved animal health management due to ketosis screening	
a) Reduction of milk loss by 50%	375
b) Prevention of 50% of the associated diseases	375
Total gain	**600**

Return on investment: 4

A MESSAGE TO TAKE HOME

- Experience from 3 years of ketosis screening in Canada, France, Belgium and the Netherlands using FTIR technology on regular DHI milk samples:
  - Simple, practical and at low cost for milk producer
  - Elevates awareness of an otherwise undetected problem
  - With monthly testing, not all cows are tested in the period most at risk
- Ketosis screening offers high value to milk recording clients → can help reduce the incidence of the problem
- Development of recommendations for generation, application and interpretation of results



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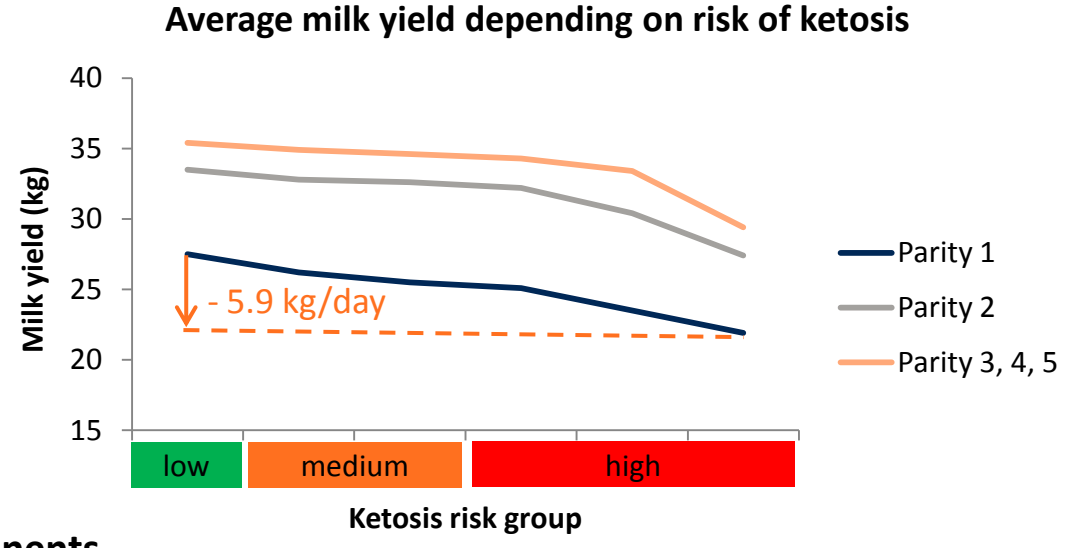
APPENDIX: KETOSIS IMPACTS PRODUCTION

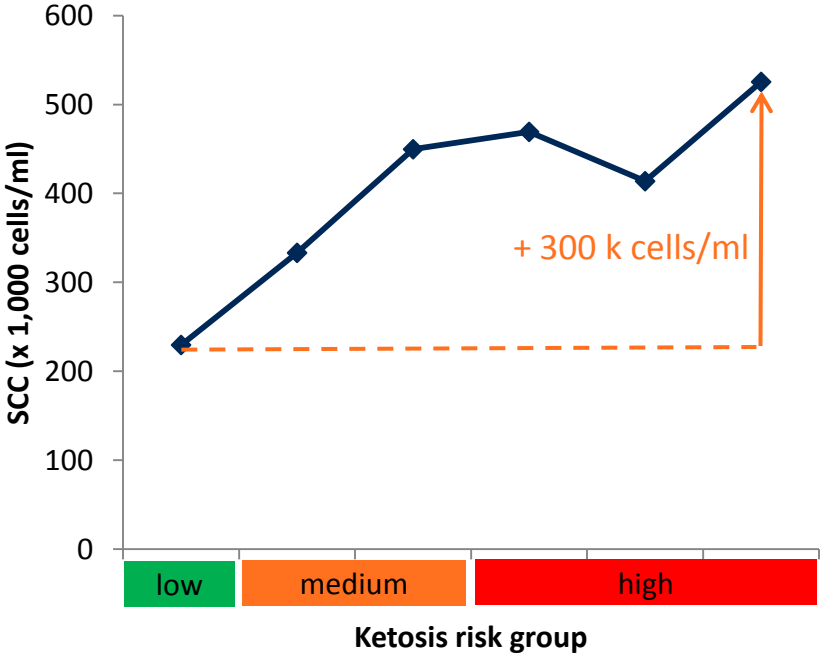


Impacts on Test Day Milk Yield and Components

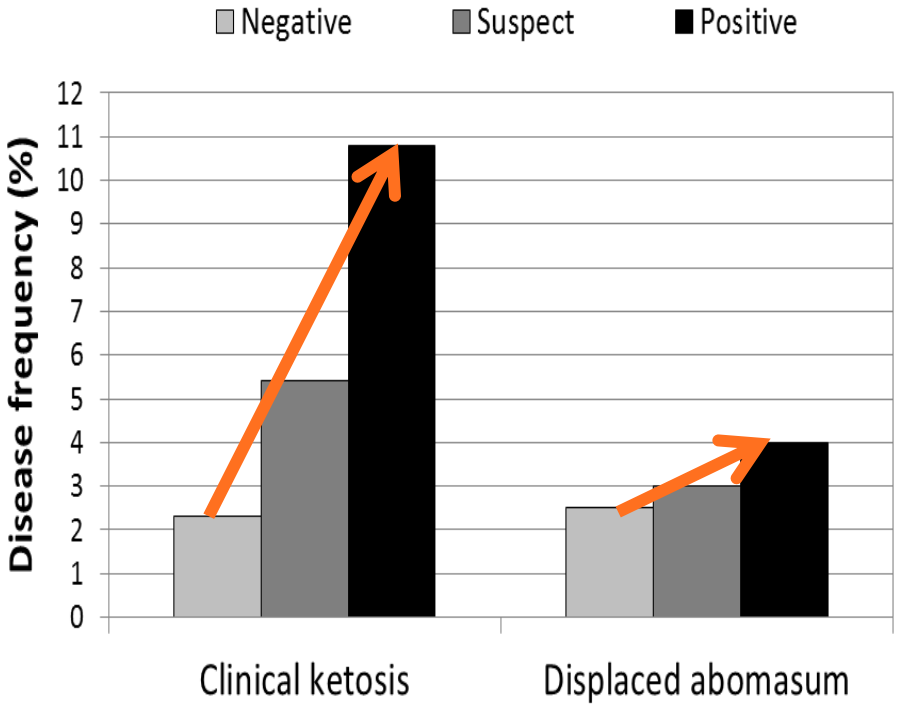
	Ketosis risk group				
	low	med	high	SE	P
Milk yield (kg/d)	32.5^{b}	32.3^{b}	30.1^{a}	0.2	0.001
Fat (%)	4.10^{a}	4.62^{b}	5.07^{c}	0.02	0.001
Protein(%)	3.25^{c}	3.17^{a}	3.19^{b}	0.01	0.001
Fat:protein ratio	0.82^{c}	0.71^{b}	0.65^{a}	0.01	0.001

APPENDIX: ASSOCIATION WITH OTHER DISEASES

SCC (mastitis) depending on risk of ketosis

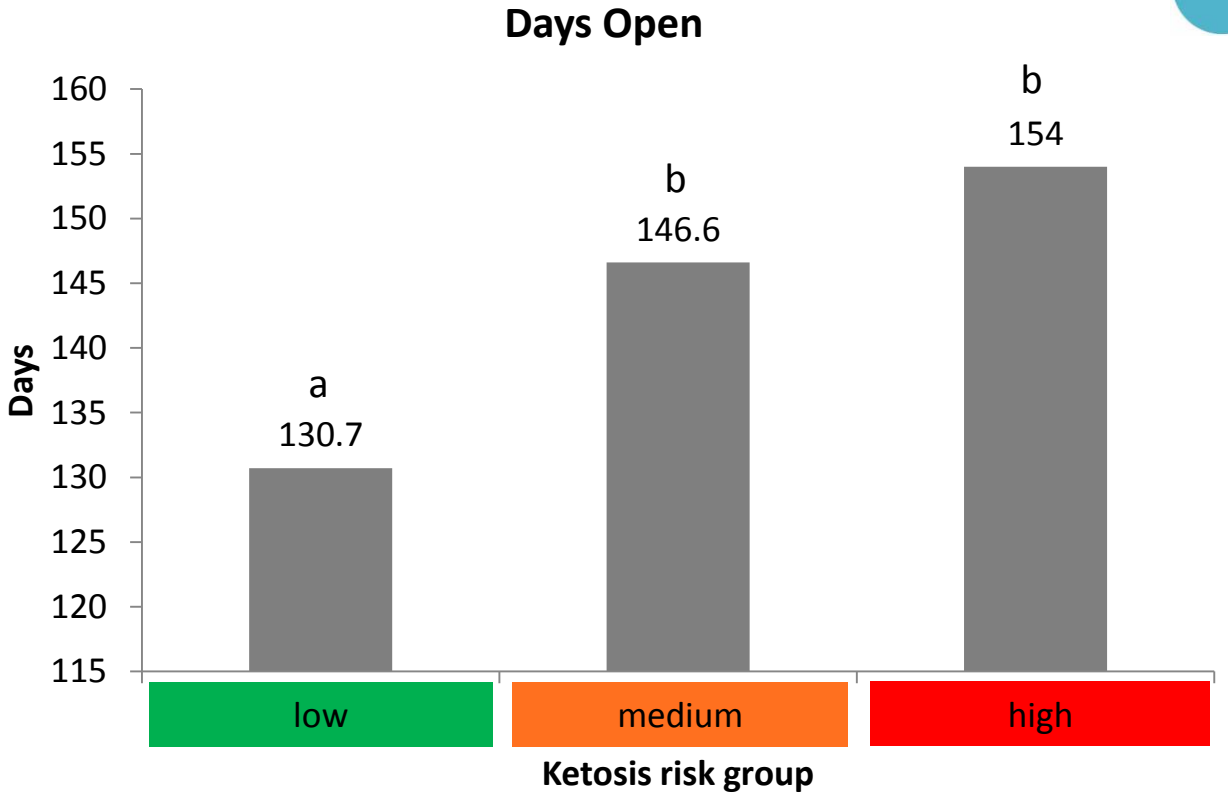


Frequency of clinical ketosis and displaced abomasum depending on the risk of ketosis



Koeck *et al.*, 2014

APPENDIX: KETOSIS IMPACTS REPRODUCTION



a, b: bars with different letters differ significantly at a level of P <0.001

APPENDIX: KETOSIS SCREENING – FROM DHI LABORATORY TO FARM

valacta

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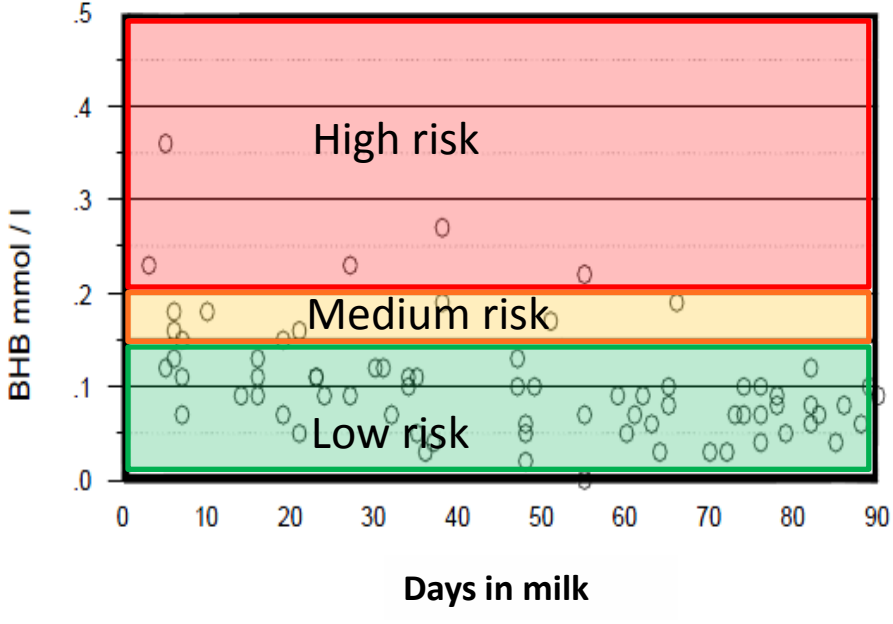
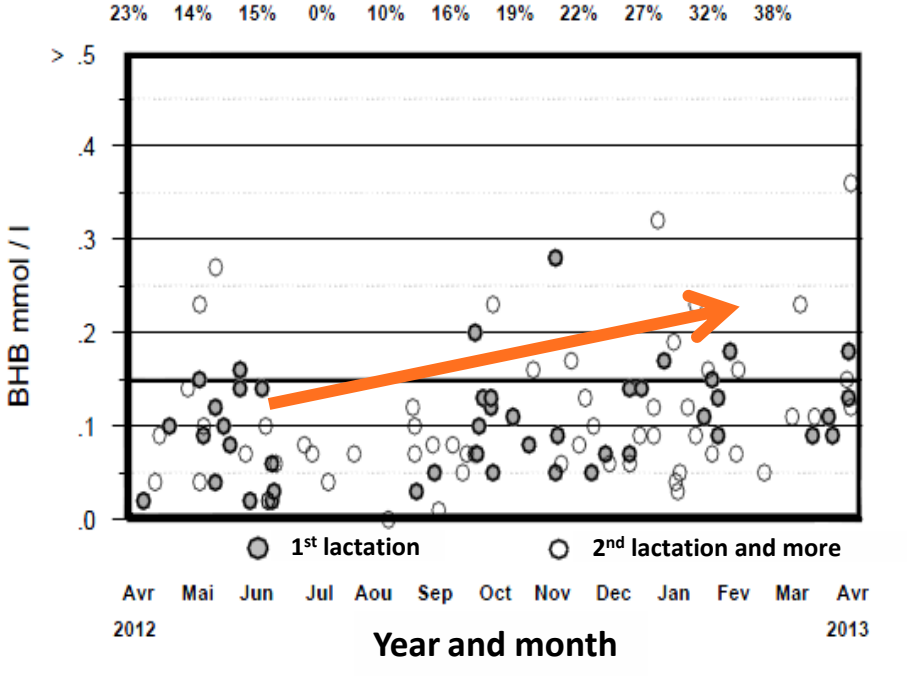


→ Information about type of ketosis present (i.e. type I vs. II)

Overview 2:
BHB values at first test day over time



→ Tendency of ketosis within herd

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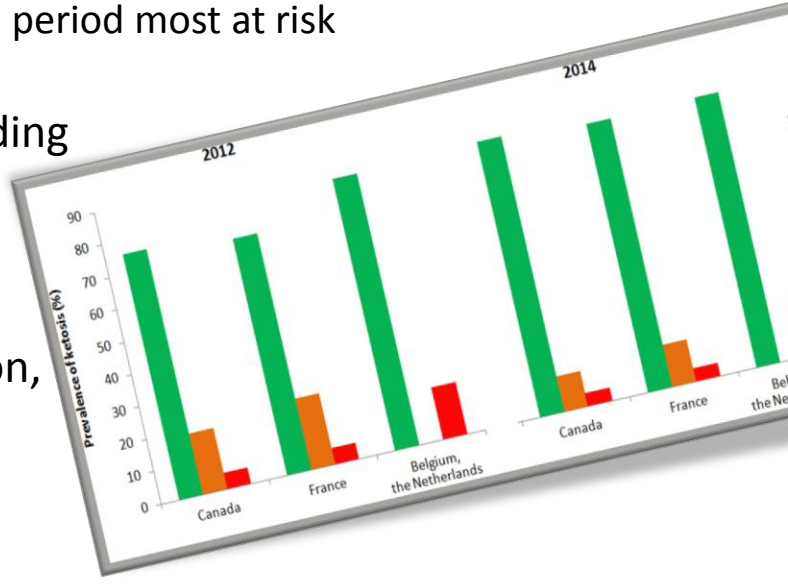

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