

Detection of ketosis in dairy cattle by determining infrared milk ketone bodies in milk

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- **Deviation of carbohydrate and lipid metabolism** associated with significant energy deficit between supply and need:
Intense mobilization of body fat
Incomplete utilization of long chain fatty acids
Accumulation of ketones in the blood, urine and milk
- **Syndrome observed in early lactation** (1st, 2nd or 3rd month of lactation)
- **Gradual symptoms**: animal healthy, subclinical ketosis, clinical ketosis



Ketosis: 3 Types

Three types of ketosis are described according to the origin of the causes favoring the development of this disease:

Type I: **insufficient energy intake**. Not suitable feeding techniques may limit the energetic concentration, inappetence due to several causes (lameness, mastitis, milk fever) resulting in an inability swallowed up.

Type II: **fat cow syndrome**. Mismanagement of food during the dry period.

Type III: **ketogenic ration**. Butyric acid is a precursor of ketone bodies. This acid is found in high concentrations in silage of poor quality.





- **Clinical symptoms**
 - Loss of appetite
 - Preferred forage to concentrates
 - acetone odor in the mouth, urine
- **Drop in production**
- **Changing milk composition** (increased fat / protein ratio)
- **Disturbance of reproduction**
- **Increases the frequency of intercurrent diseases** (mastitis, displaced abomasum, metritis ...)



- Metabolic disease **underdiagnosed** in breeding
- Clinical ketosis: **3-4%** of cows
- Subclinical ketosis between **7 and 14% of animals**
(Achard T. 2005, PhD ENVN)
- Current indicator: Ratio Fat / Proteine > 1.5
 - Sensitivity: 58%
 - Specificity: 69% (Duffield et al. 2000)

Ratio Fat/proteine is not enough specific ↔ need an accurate indicator



New Indicateur based on wich molecules? Bibliography

- Which ketone body?
Acetone - Beta-hydroxybutyrate - Aceto-acetate (unstable)
- Concentration in the blood is a good indicator of ketosis
- Correlation ketones blood / milk is medium (Enjalbert 2011: 0.66 for the BHB)
- Correlation Infrared Milk ketones - Chemical reference
average milk: 0.79 (Ross 2007)
- Subclinical ketosis level in milk (chemistry reference method): BHB 0.1 mmol / l - Acetone 0.15 mmol / l



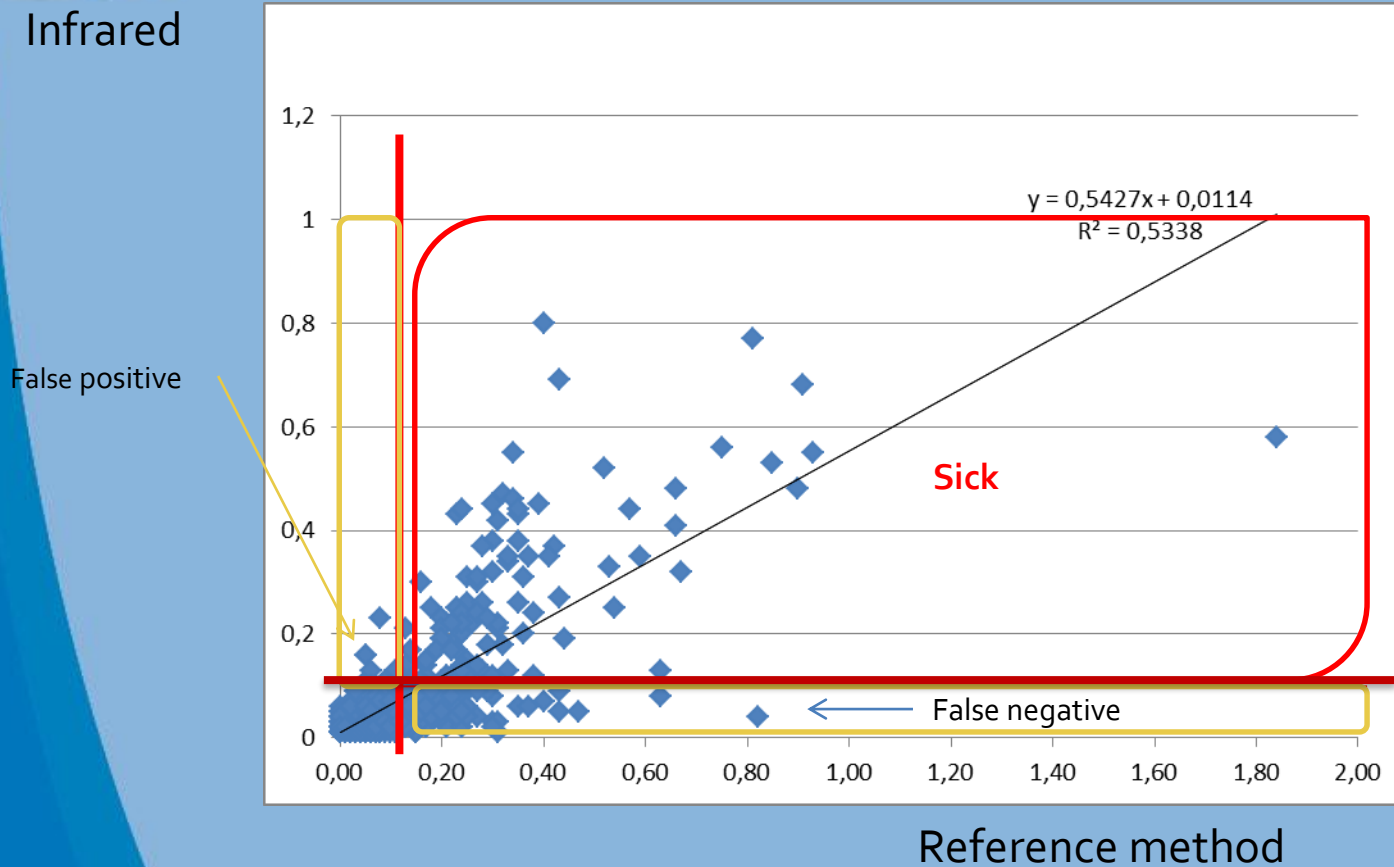
- Providing of 2.1 Foss calibration
- Ability to fill in the milk two ketone bodies used like ketosis markers:
The Beta-Hydroxybutyrate (BHB) and Acetone (Ac)
- 492 reference samples (92 in January to 400 in June 2011)



BHB

Infrared

Unit: mmol/l



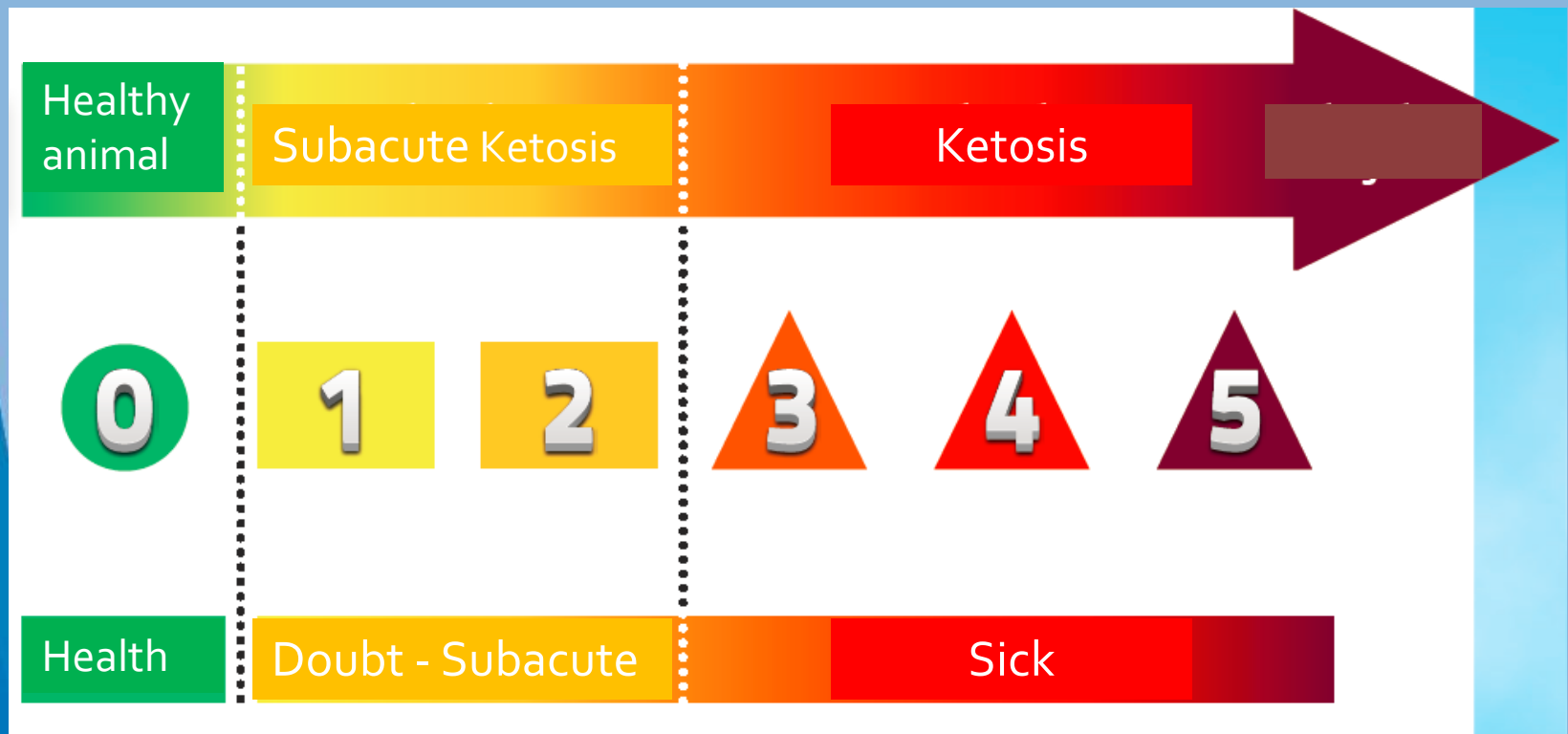
		Reference		
		Sick	Health	
Diagnoses	sick	98	9	Positive predictive value : 92%*
	Health	10	67	Négative predictive value : 87%*
Total		108	76	*For information on these frequency sick/health
		Sensibility : 91%	Specificity : 88%	

More than 9 on 10 sick cows are detected by the model (sensitivity)

When the model says that a cow is sick, it is true more than 9 times out of 10 (VPP)

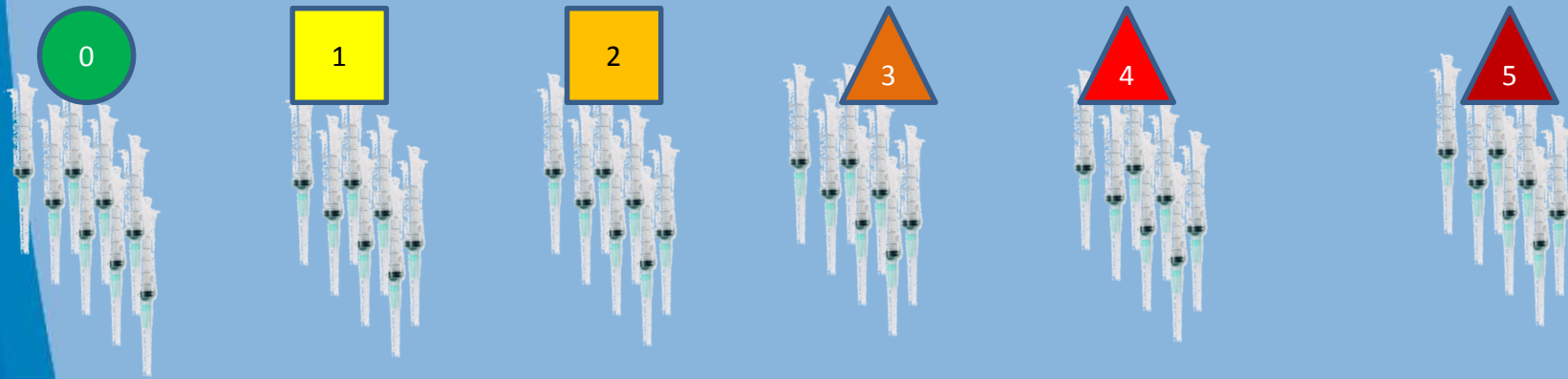


KETODECTECT®



What about blood

Validation data: 10 blood samples in each class:



Blood profile on:

BHB

glucose

Hepatic enzymes (Asat - Gamma GT)

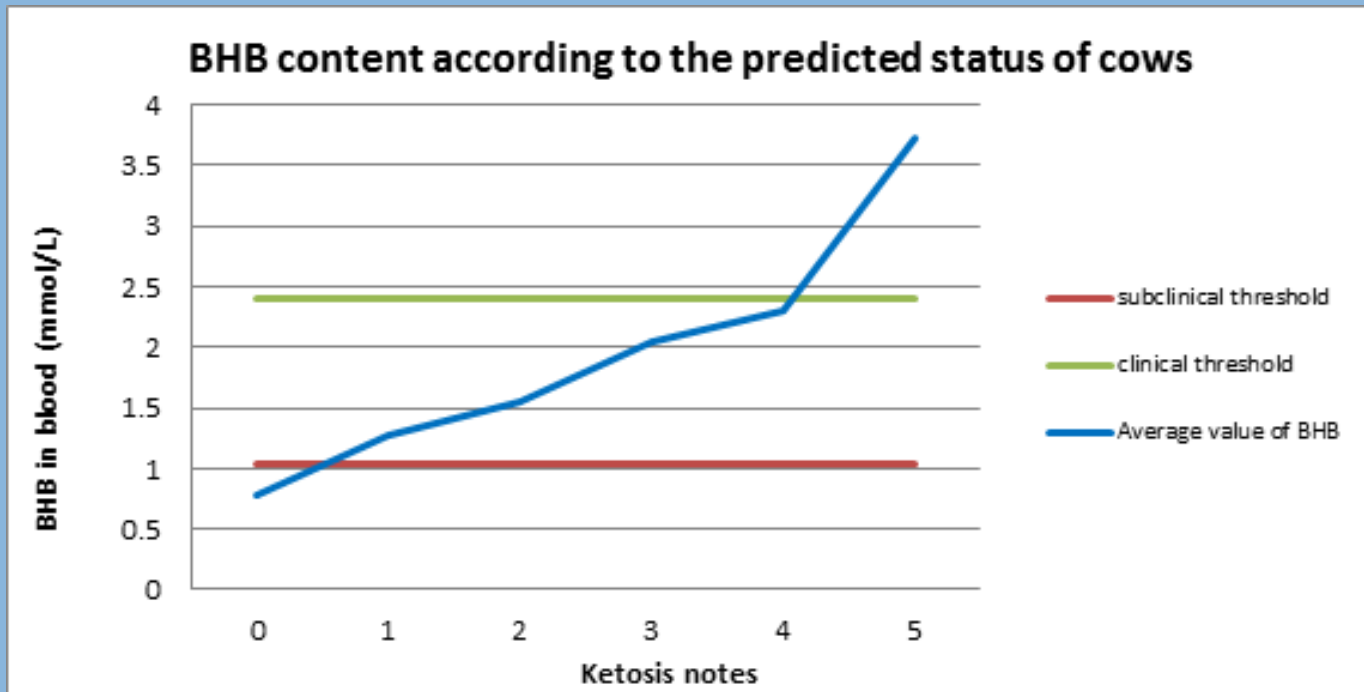
urea

triglycerides

albumin



The proofs in the blood

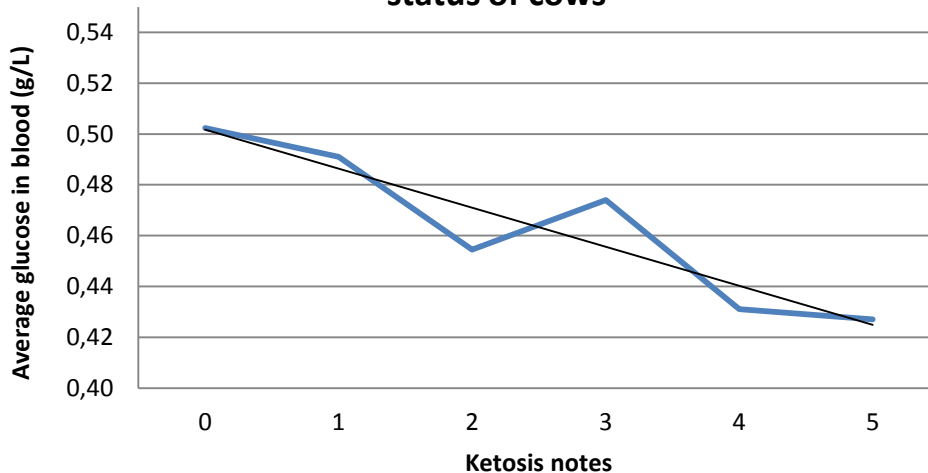


Linear evolution of blood BHB concentration according to the ketosis note
Note 3: sub-clinical or clinical?



The proofs in the blood

Blood glucose content according to the predicted status of cows

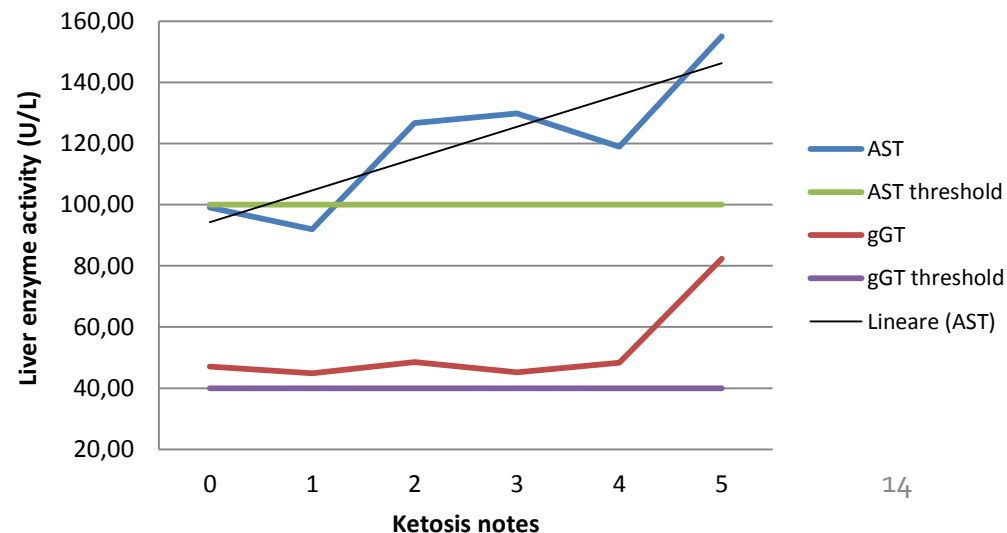


With increasing Ketosis note:

- Decrease proportional blood glucose
- Increased liver enzymes indicative of suffering

Non-significant relationship between this sample and note CETODETECT Urea - Triglycerides - Albumin

Liver enzyme activity according to the predicted status of cows

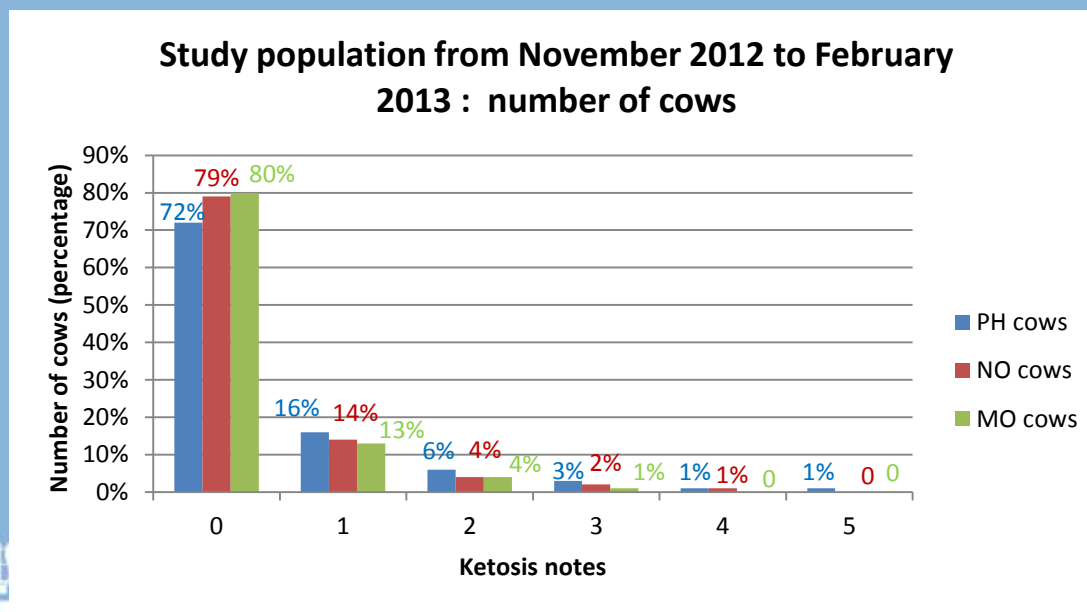


➤ The frequency of clinical and subclinical ketosis (note KETODETECT® from 1 to 5) changes according to seasons and diets :

15% summer 2012 ; 12% sept/oct. 2012 ; 25% winter 12/13 ; 14% winter 13/14

Study population from November 2012 to February 2013 – 162,742 data – 3 breeds: PH (Prim'Holstein) (115,960 data), NO (Normande) (39,532 data), MO (Montbeliarde) (7,250 data)

	CetoDetect®					
	0	1	2	3	4	5
Number of data	122 030	25 867	9 309	3 076	1 885	1 340
Percentage	74.63	15.82	5.69	1.88	1.15	0.82

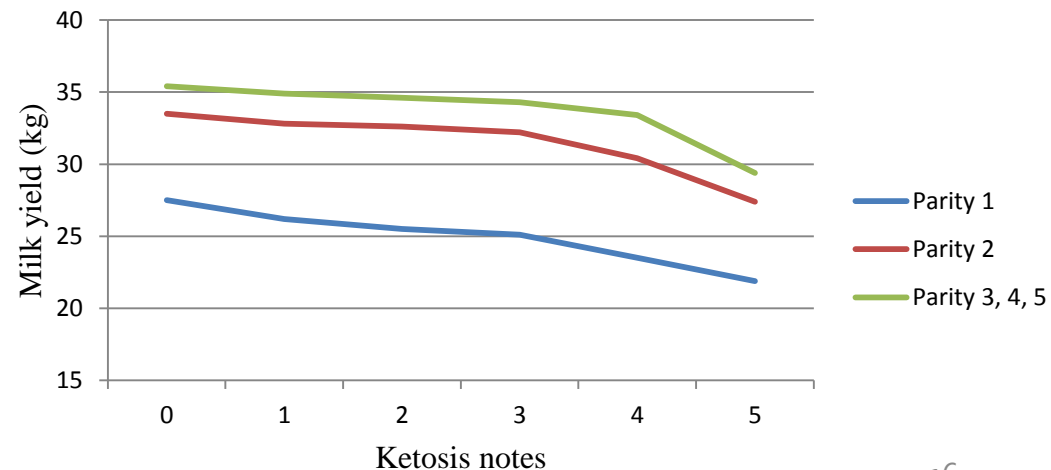


Milk production based on ratings KETODETECT® and lactation rank Analyse on 115960 P'H

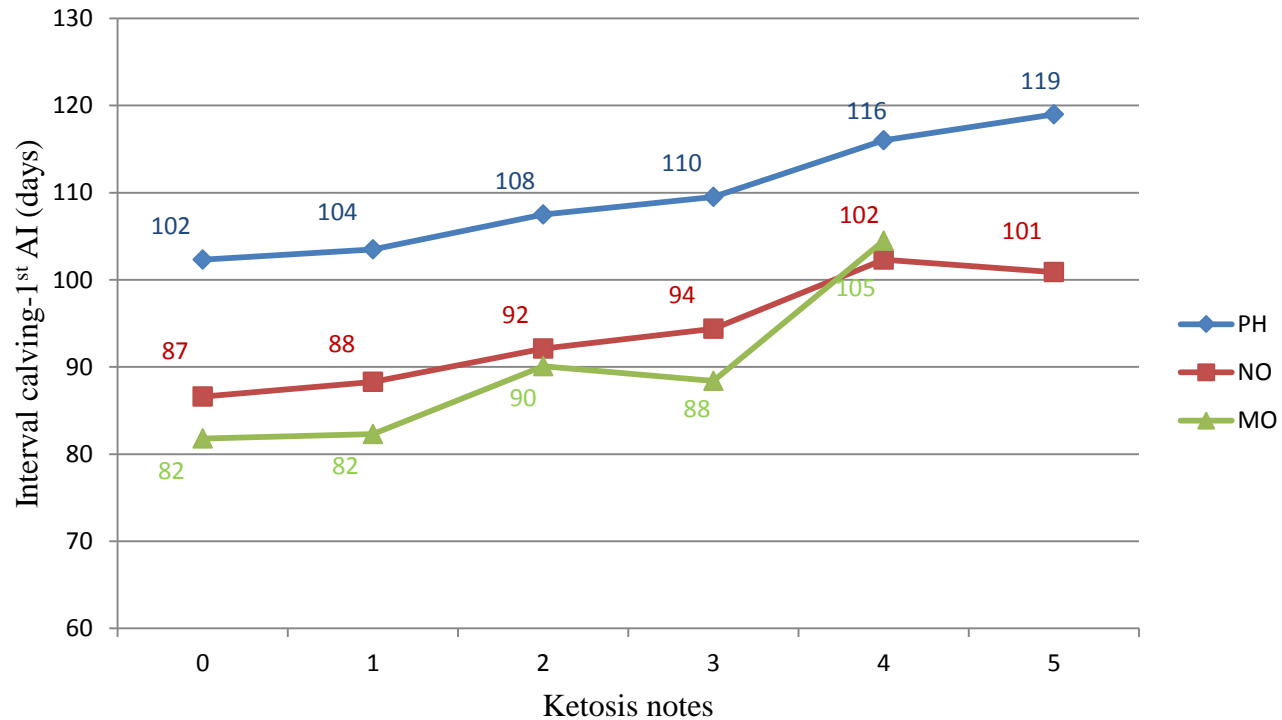
	CetoDetect®					
Average milk yield (kg)	0	1	2	3	4	5
1st lactation	27.5	26.2	25.5	25.1	23.5	21.9
<i>dairy accumulated losses</i>		-1.3	-2	-2.4	-4	-5.6
2nd lactation	33.5	32.8	32.6	32.2	30.4	27.4
<i>dairy accumulated losses</i>		-0.7	-0.9	-1.4	-3.1	-6.1
3rd lactation	35.4	34.9	34.6	34.3	33.4	29.4
<i>dairy accumulated losses</i>		-0.6	-0.8	-1.1	-2.1	-6.1

A significant decrease in milk production in case of problems, up to 6 kg of milk on average.

Average milk yield according to the predicted status of cows



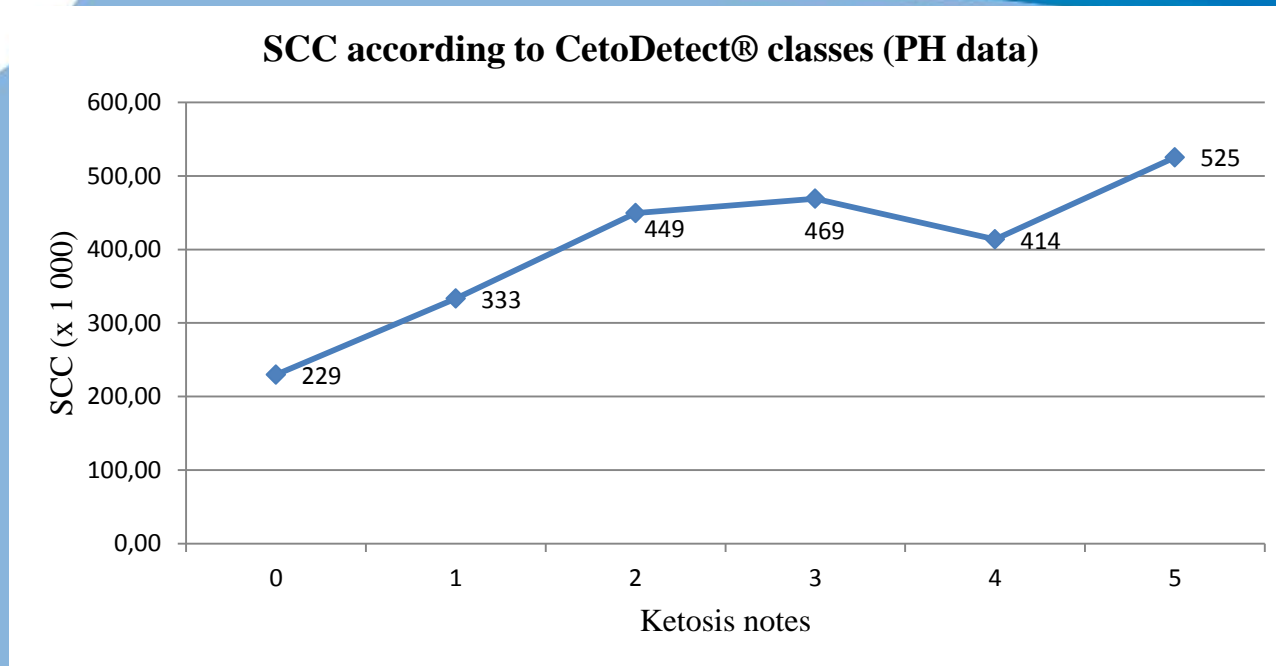
Interval between calving and 1st AI according to CetoDetect® classes



Strong impact of ketosis on the time-breeding dairy cows (until ovarian cycle whether 22 days)

Bibliographic source (JDS) : Success rate in the first IA divided by 2!
Metritis number multiplied by 3.





Turning abomasum : increased by 4 to 8 times frequency!

Lameness

Reforms: higher probability 1.4 and 2 times more to be reformed during or at the end of lactation



The offer

closet
Fédération Française des Elevages

OSMO5

TABLEAU DE BORD PAR VACHE

EARL BERANGERIE DE LA
LA BERANGERIE
53 390 JUVIGNE
N° élevage : 53 123 484

Secteur : DIA
Procédure : AT
Date du contrôle : 13072012

RÉSULTATS DU CONTRÔLE

N° vache	Statut	Moyennes				N°	Niveau de conformité				N°					
		Produit	UPL	UPL	UPL		Produit	UPL	UPL	UPL						
965	D	124	42,7	33,7	16	476	VALEUR	PH	4	060311	406	12 744	42,2	31,9	13 490	
177	S	23,9	-18	47,9	31,6	5	474	ADELLE	PH	4	091212	155	4 185	44,3	35,2	4 733
459	D	13,8	-23	42,7	31,7	7	473	AMANDA	PH	4	010811	349	9 324	40,2	32,4	9 241
385	D	27,8	50,5	35,2	11	475	BERLINE	PH	4	100612	34	9 324	40,2	32,4	9 241	
57	S	19,4	-32	36,2	35,2	1	472	BLANCHE	PH	3	101011	217	7 105	37,1	29,3	7 162
448	S	17,4	-32	36,2	35,2	1	478	SABINE	PH	3	241011	217	7 105	37,1	29,3	7 162
97	D	17,4	-32	36,2	35,2	1	479	BOTTINE	PH	3	120112	264	7 441	40,2	36,3	8 112
448	S	17,4	-32	36,2	35,2	1	479	BOTTINE	PH	3	300412	184	9 115	46,2	29,9	8 334
12	D	13,1	45,9	35,5	12	484	BOTTINE	PH	3	110711	75	2 641	45,3	29,8	2 840	
13	S	28,4	29,0	28,3	3	484	BOTTINE	PH	3	280212	258	10 213	39,5	30,7	10 242	
568	D	13,1	45,9	35,5	12	484	BOTTINE	PH	3	110711	40	1 781	31,4	29,7	1 928	
2	S	27,9	-20	31,9	28,3	3	485	BOTTINE	PH	3	110711	210	6 889	36,7	32,4	6 939
79	S	27,9	-20	31,9	28,3	3	485	BOTTINE	PH	3	110711	142	4 877	46,1	31,0	5 295
89	D	14,4	46,9	37,1	13	488	BOTTINE	PH	3	110711	414	10 569	40,3	31,6	10 891	
24	S	9,0	55,0	37,7	9	489	BOTTINE	PH	3	110711	444	12 646	40,3	31,6	13 028	
53	S	32,4	-29	38,8	27,3	2	485	BOTTINE	PH	3	110711	398	4 952	44,3	32,1	5 773
47	S	18,0	38,3	30,0	10	485	BOTTINE	PH	3	110711	540	6 942	54,6	39,3	7 336	
79	S	32,4	36,4	24,5	2	485	BOTTINE	PH	3	110711	910	9 150	49,1	43,0	9 629	
59	S	20,7	35,5	29,5	8	486	BOTTINE	PH	3	110711	1 645	15 645	34,9	29,4	16 491	
27	S	9,5	-16	41,8	32,8	4	489	BOTTINE	PH	3	110711	1 940	19 400	40,2	34,3	19 955
53	D	19,8	-35	41,0	28,4	9	489	BOTTINE	PH	3	110711	2 974	29 740	40,2	34,3	30 655
2	D	16,7	-42	35,5	2	489	BOTTINE	PH	3	110711	1 122	11 220	36,3	32,4	11 857	

Page 1 of 2

annual engagement

Price: 3 € / cow / year



Simulation for a herd of 50 cows

	Economic losses
milk losses	
300 liter x 330€/1000L milk x 50 cows x 15%	750 €
increase of pathologies	
2 mastitis x 150€	300 €
3 metritis x 50€	150 €
lameness/displaced abomasum/other	300 €
	1 500 €

New indicator: $3 \text{ €/VL} * 50 \text{ VL} = 150 \text{ €}$

Simulation for a herd of 50 VL the best knowledge of the status of the animal adjusts 2/3 of the problems: $1500 \text{ €} * 0,66 = 1000 \text{ €}$

Gain of 1,000 € is a return on investment of **6 to 8!**

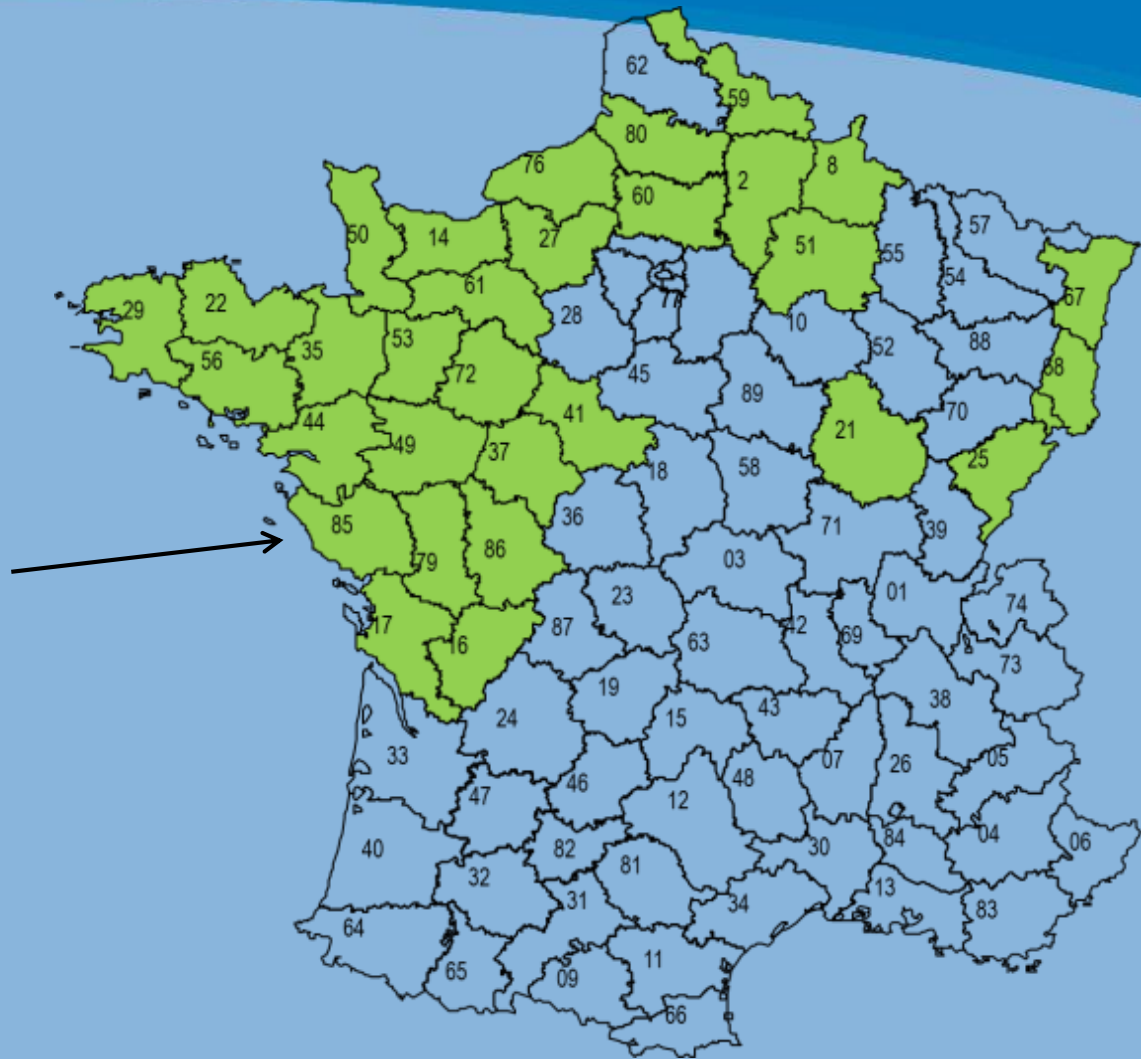




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CetoDetect® Membership

Membership
17 MRO
30 countries
62 % herds
65 % cows



CÉT  **DÉTECT**





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Donner du sens à la mesure

Stratégic interest

New indicator:

Adds value on Milk Recording samples

Reinforces the dimension advice: the link between Performance, Nutrition and Health Service → high perceived value

Consolidates MRO in a competitive environment

Strengthens the commercial range if it exists

Helps to **maintain the innovative view** of MRO



CÉT DÉTECT

Detection of ketosis in dairy cows

Thank you for your attention



For the health of your herd
targeting the essential