Use of a highly accurate enzymatic method to evaluate the relationship between Milk Urea Nitrogen, milk composition and yield on bulk and individual milk samples

Rapid determination of somatic cells and total flora in cow, goat, sheep and buffalo milk

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THE AS62 DHIA LABORATORY UREA EXPERIENCE

MATERIALS AND METHOD

- Started a UREA testing program in 1995 with infrared technology. Accuracy was found to be insufficient to explain the observations made on the field and fully optimize the feeding program
- Decided to switch to chemical analysis in 1998 with the introduction of the ChemSpec enzymatic method
- Retrospective Analysis of individual cows records (2003-2005) from monthly DHIA tests collected by the AS62 DHIA laboratory (Maroeuil, France)
- ~ 600 000 individual cow milk samples tested for fat, protein, somatic cells and urea
- Determination of the fat, protein and somatic cells content on the *Bentley B2000* Milk Analyzer
- Determination of the Somatic Cells count on the *Bentley Somacount* (flow cytometry)
- Determination of the Urea Content on the *Bentley ChemSpec* (enzymatic)
- HERD Mean Values grouped by Urea Classes (1 mg/dl increment)
- Develop their own specific diagnostic grid to optimize the use of urea values

MATERIALS AND METHOD

ChemSpec 150 Milk Urea Analyzer

C. LHOMME – AS62 General Manager
G. HEUMEZ – AS62 Technical Director

~ 600 000 milk samples tested for urea every year
- 4 ChemSpec 150

ChemSpec Method Principle

- Enzymatic reaction + colorimetric detection (green)
- Differential measurement (with/without enzyme)
- 150 samples/hour
- Fully automated
- No sample preparation (4°C - 40°C)
- Method highly specific → One Calibration Std.
- Method highly accurate ($s_{y.x}$ < 1 mg/dl urea)

ChemSpec 150 Accuracy

Bulk Milk Samples

Instrument	N	Sy.x	Reference Methods	Sources
ChemSpec 150	10	0.17	Enzymatic + pH Differential	Cecalait Ring test (1997)
ChemSpec 150	10	0.19	AFNOR NF V04-217	Cecalait Ring test (1997)
ChemSpec 150	10	0.21	DMAB	Cecalait Ring test (1997)
ChemSpec 150	10	0.26	Enzymatic + Colorimetric	Cecalait Ring test (1997)
ChemSpec 150	78	0.77	DMAB	Broutin(1998)
ChemSpec 150	30	0.88	Enzymatic + pH Differential	Broutin(1997)
ChemSpec 150	233	0.96	Enzymatic + pH Differential	Associazione Regionale Allevatori Laboratory, Crema, Italy (2000)
ChemSpec 150	96	0.74	Enzymatic + pH Differential	Compilation of the National DHIA MUN reports (Jan to August 2002)
ChemSpec 150	49	1.58	Enzymatic AFNOR NF V04-217	Cecalait Evaluation (1999)
Chemspec 150		<1.00	Enzymatic + pH Differential	Manufacturer specification
Filter IR		< 4.5		Manufacturer specifications
FTIR		< 3.0		Manufacturer specifications

ChemSpec Accuracy >> FTIR and Filter IR Methods

ChemSpec 150 Accuracy

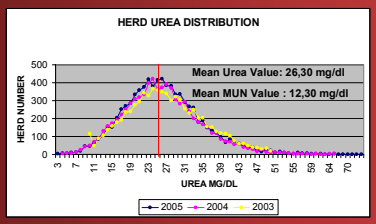
Individual Milk Samples

Instrument	N	Sy.x	Reference Methods	Sources
ChemSpec 150	129	0.82	Enzymatic + Conductivity	Milchprufung Niederosterreich Laboratory, Austria (2000)
ChemSpec 150	139	1.00	DMAB	Broutin(1998)
ChemSpec 150	158	1.26	Enzymatic + pH Differential	Broutin(1999)
ChemSpec 150	98	2.10	Enzymatic AFNOR NF V04-217	Cecalait Evaluation (1999)
ChemSpec 150		< 1.5	Enzymatic + pH Differential	Manufacturer specification
Filter IR		< 6.0		Manufacturer specifications
FTIR		< 3.5		Manufacturer specifications

ChemSpec Accuracy >> FTIR and Filter IR Methods

THE AS62 DHIA LABORATORY UREA EXPERIENCE

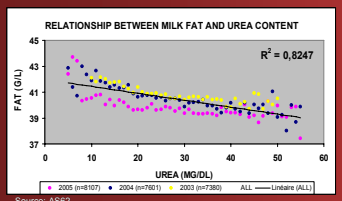
HERD UREA FREQUENCY DISTRIBUTION



~ 23000 Herds ~ 600 000 samples tested over 3 years

MUN = UREA/2.145

Relationship between Milk Urea and Fat Content (~23000 herds)

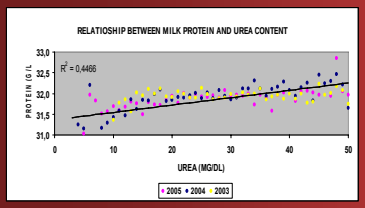


Source: AS62

UREA CLASSES (MG/DL)		MEAN FAT(G/L)
<10		41,75
>10	<20	41,09
>20	<30	40,31
>30	<40	39,94
>40	<50	39,83
	MAX DIFF	1,92

→ STRONG NEGATIVE CORRELATION BETWEEN UREA AND FAT CONTENT

Relationship between Milk Protein and Urea content (~23000 herds)

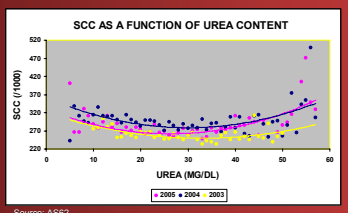


Source: AS62

UREA CLASSES (MG/DL)		MEAN TP (G/L)
<10		31,25
>10	<20	31,81
>20	<30	31,94
>30	<40	32,00
>40	<50	32,06
	MAX DIFF	-0,82

→ Positive correlation between urea and protein content

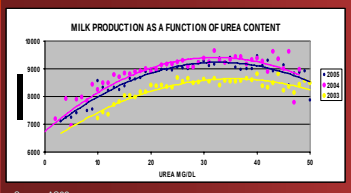
Relationship between Milk Somatic Cells and Urea content (~23000 herds)



Source: AS62

→ negative correlation in lower urea range (<30 mg/dl)
→ positive correlation in higher urea range (> 30 mg/dl)

Relationship between Milk Production Level and Urea content (~23000 herds)

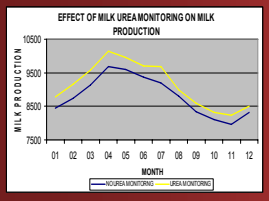


Source: AS62

UREA CLASSES		MILK YIELD
<10		7399
>10	<20	8323
>20	<30	8885
>30	<40	9030
>40	<50	8803
	MAX DIFF	1631

→ Strong positive correlation (< 30 mg/dl)
→ Negative correlation (> 40 mg/dl)

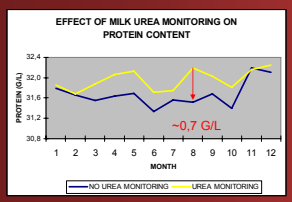
Effect of the Milk Urea Monitoring on Milk Production Level



Source: AS62

MONTH	WITH	WITHOUT	DIFF	%
01	8287	8619	-331,87	-4,0
02	8518	8929	-411,09	-4,8
03	8879	9354	-474,72	-5,3
04	9520	9922	-402,01	-4,2
05	9574	9957	-383,21	-4,0
06	9160	9512	-352,66	-3,9
07	8990	9326	-336,35	-3,7
08	8836	9249	-412,33	-4,8
09	8448	8741	-293,63	-3,5
10	7976	8347	-370,73	-4,6
11	8124	8373	-249,24	-3,1
12	8252	8507	-255,34	-3,1
MEAN	8689	9053	-364	-4,19

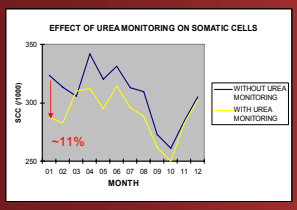
Effect of Milk Urea Monitoring on Milk Protein Content



Source: AS62

MONTH	WITH	WITHOUT	DIFF	%
01	31,79	31,85	-0,06	-0,19
02	31,66	31,70	-0,04	-0,12
03	31,55	31,87	-0,32	-1,03
04	31,64	32,06	-0,42	-1,34
05	31,69	32,13	-0,44	-1,39
06	31,33	31,72	-0,38	-1,23
07	31,56	31,74	-0,18	-0,58
08	31,65	32,33	-0,68	-2,16
09	31,68	32,03	-0,35	-1,11
10	31,39	31,82	-0,42	-1,35
11	32,20	32,25	-0,05	-0,17
12	32,10	32,25	-0,15	-0,47
MEAN	31,68	31,97	-0,29	-0,92

Effect of Urea Monitoring on Somatic Cells Level



MONTH	WITH	WITHOUT	DIFF	%
01	323	337	-14,33	-4
02	313	299	14,67	5
03	306	310	-4,24	-1
04	342	312	29,33	9
05	320	295	24,98	8
06	331	314	16,85	5
07	313	296	16,75	5
08	310	288	21,58	7
09	273	262	10,84	4
10	261	250	11,08	4
11	284	282	1,87	1
12	305	302	2,74	1
MEAN	307	290	17	5,70

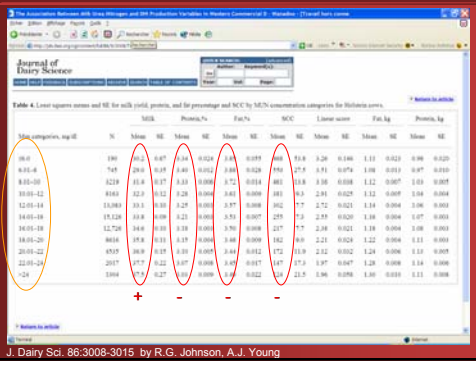
ROCKY MOUNTAIN DHIA EXPERIENCE

MATERIALS AND METHOD

- 24 months retrospective analysis of individual cows records from monthly DHIA tests collected by Rocky Mountain DHI
- 49 Holstein Herds
- 69724 individual cow records (fat, protein, somatic cells and urea)
- Determination of the fat, protein and somatic cells content on the *Bentley B2000* Milk Analyzer
- Determination of the Somatic Cells count on the *Bentley Somacount* (flow cytometry)
- Determination of the Urea Content on the *Bentley ChemSpec*
- **INDIVIDUAL COW VALUES** grouped by Urea Classes (~4 mg/dl increment)

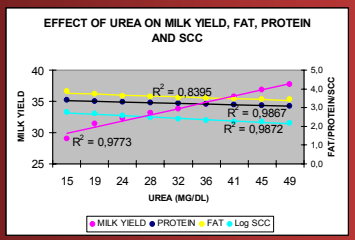
The Association between milk urea nitrogen and DHI production variables in Western Commercial Dairy Herds

(*Urea values data treated at the **COW** Level*)



J. Dairy Sci. 86:3008-3015 by R.G. Johnson, A.J. Young

The Association between milk urea nitrogen and DHI production variables in Western Commercial Dairy Herds



CONCLUSIONS

THESE STUDIES SUGGEST THAT:

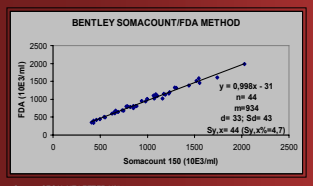
- THERE ARE STRONG RELATIONSHIPS BETWEEN UREA, FAT, PROTEIN AND SOMATIC CELLS CONTENT AS WELL AS MILK PRODUCTION.
- THE ACCURATE DETERMINATION OF UREA ON INDIVIDUAL COWS CAN BE A VERY USEFUL TOOL TO OPTIMIZE FEEDING PROGRAMS AND INCREASE MILK PRODUCTION AND PROTEIN CONTENT

A VERY SUCCESSFUL EXPERIENCE:

- THE AS62 DHIA LABORATORY IS NOW PERFORMING 600 000 UREA TESTS ON INDIVIDUAL COWS EVERY YEAR (60% OF THE PRODUCERS) ON THE CHEMSPEC (4)
- THE NUMBER OF TESTS IS STILL INCREASING DUE TO THE TEST ADDED VALUE (ONLY COMPONENT)
- THE MARKET DEMAND WILL ORIENTATE OUR CHOICES BUT THE CHEMSPEC SPEED COULD BE SIGNIFICANTLY INCREASED TO REACH OUR CUSTOMERS NEEDS

Rapid Determination of Somatic Cells in Goat Milk by Flow Cytometry

CECALAIT Evaluation



Source: CECALAIT LETTER N°54

Classes	0-2000	0-1000	1000-2000
N	44	24	20
Sr	13	9	17
Sr(%)	1,40%	1,30%	1,30%

Source: CECALAIT LETTER N°54

- Somacount Somatic Cells Counter (FC) calibrated with CECALAIT **COW** CRM samples
- Sy.x (%) = 4,7%
- Sr(%) = 1, 4%

Rapid and accurate determination of milk total flora by flow cytometry

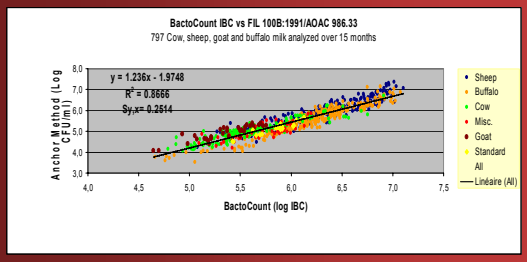
BactoCount IBC & IBCm

BactoCount 50-150

BactoCount IBCm

BactoCount IBC Universal Calibration

Cow, Sheep, Goat and Buffalo Milk



THANK YOU FOR YOUR ATTENTION

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