

Long-term measurement of rumen pH in dairy cows by an indwelling and wireless data transmitting unit



Johann Gasteiner

Institute for Animal Welfare and Animal Health
Raumberg-Gumpenstein

Introduction

- **Rumen Acidosis (SARA-20 %) and clinical cases**
- pH 6.2 – 7.2 normal
pH 5.8 – 6.2 critical
pH 5.5 – 5.8 subclinical RA
pH < 5.5 clinical RA

- **Exact definition of RA/SARA**
 - how long under a critical pH-limit?
 - how often under a critical pH-limit?
 - how fast under a critical pH-limit?

- **Different rumen fluid sampling techniques (oral stomach tubes, rumenocentesis, rumen fistula)**
- **Different locations (reticulum, fibre matt, Sacc. ventr.,...) with varying pH**

Objectives

➤ **Continuous measuring of ruminal pH**

- under practical conditions
- in high yielding dairy cows

Control the feasibility of the system

➤ **Correlation pH**

- Feeding conditions (rations composition)
- Feeding management

Interpretation of data

Examinations on 16 high yielding dairy cows (NL)

- 4 cows from 4 farms (n=16)
- Ø 10.229 kg milk yield, 3. lact.
- Continuous pH-measuring 1 week a.p. up to 80 d p.p.
- > 200.000 raw data for ruminal pH
- Serviced by „Agroscoope®“: provided us with high amount and quality of production and feeding data
- Statistics „STATGRAPHICS Centurion XVI“
- Factors for statistics: ruminal pH, rations composition, milk yield, milk quality, day of lactation,
- Interpretation of data

Rations composition (NL)

TMR	60 % - 30 %	Gras silage
	40 % - 60 %	Corn silage
	0.8 kg	Wheat straw
	- 7.0 kg	Sastapro (protein substitute)
	4.0 kg	Soy bean meal
	1.5 – 5.0 kg	Potato by-products
	1.0 kg	Wheat shredded
	3.5 kg	Spent grain
	0.35 kg	Protected fat
	0.40	Urea
	0.13 kg	Mineral supplement
	0.07 kg	Sodium Bicarbonate
	166 – 171 g	Raw protein
	145 – 180 g	Fibre

DMI: 24 kg

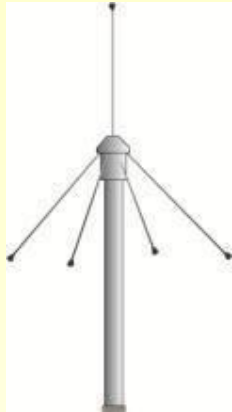
Introducing Indwelling pH Probe with Data Transmitting Unit (*Gasteiner et al. 2009*)

- **Developed an indwelling sensor**
- **Continuous measuring of pH and temperature**
- **Measurement times are user selectable (10 min.)**
- **Stored data are transmitted (ISM-Band 433 mHz) to an external receiver**
- **Receiver is connected via web with a server**
- **A software analyses and displays the results**
- **pH probes can be given to cows orally**
- **Period of continuous measurement is up to 100 days (50 days guaranteed valid data)**

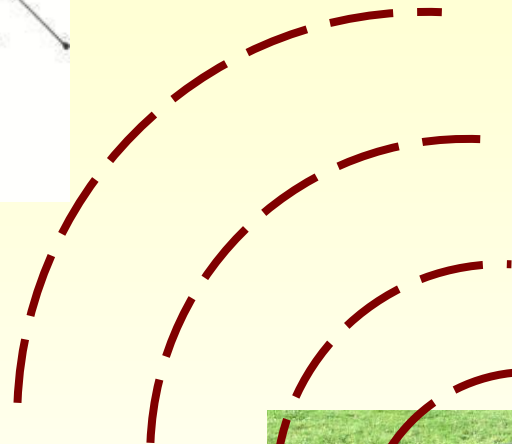
pH-Probe: Dimensions

(Length 120 mm, Diameter 36 mm, Weight 208 g)





Receiver

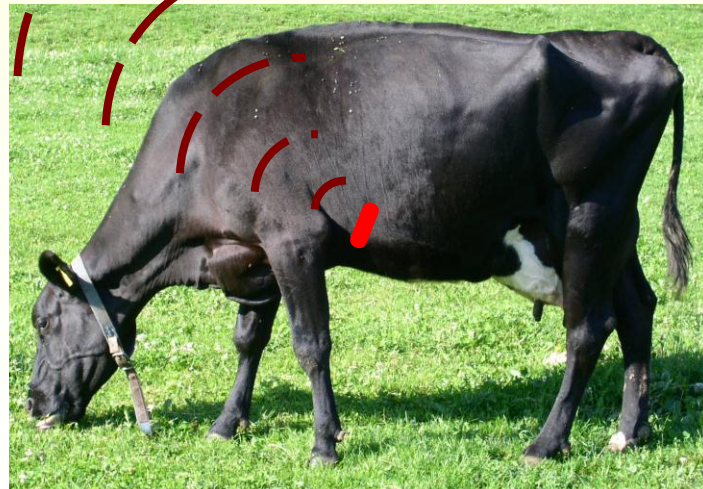


Web-Server

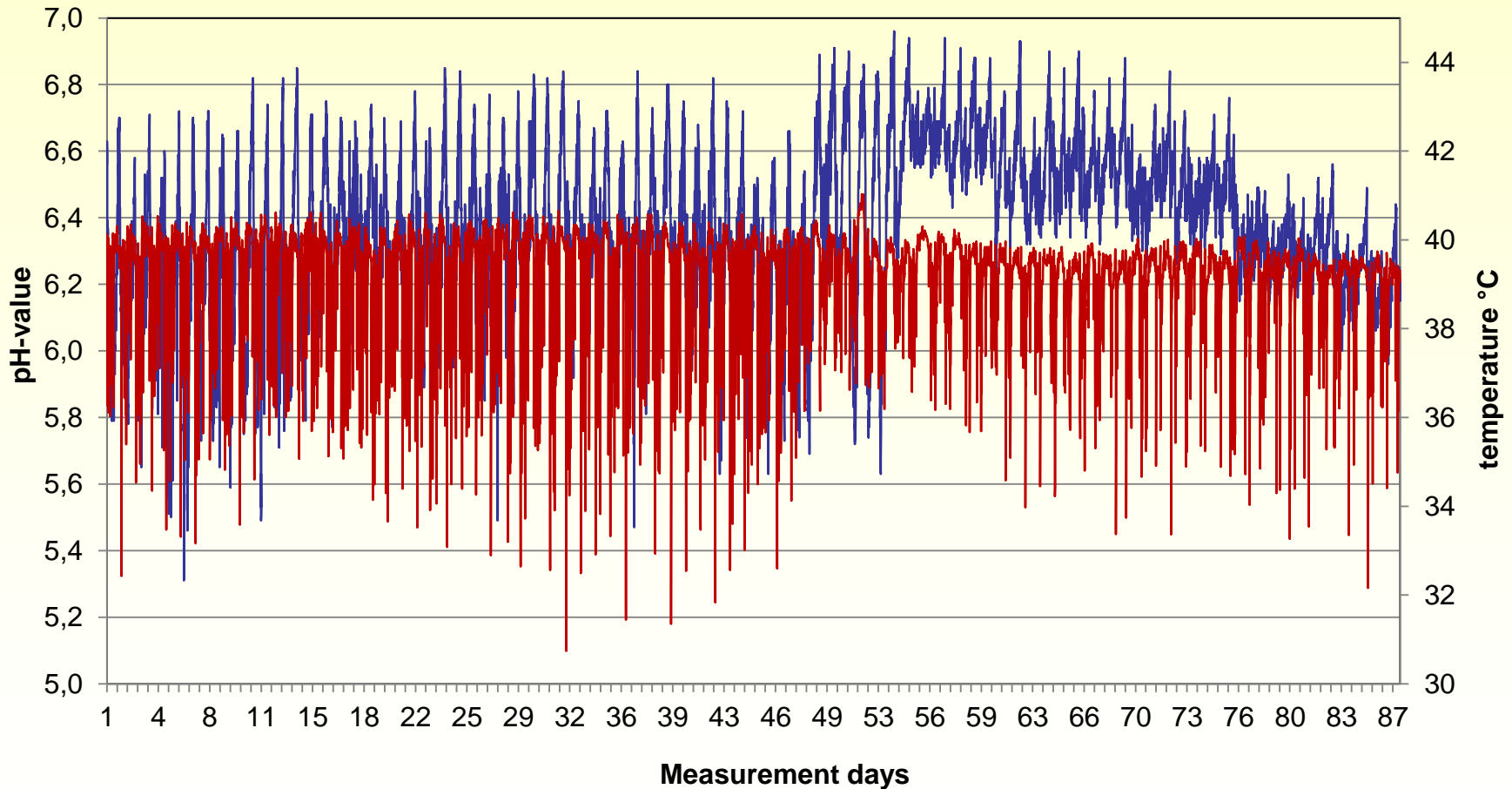


Software for Analysis

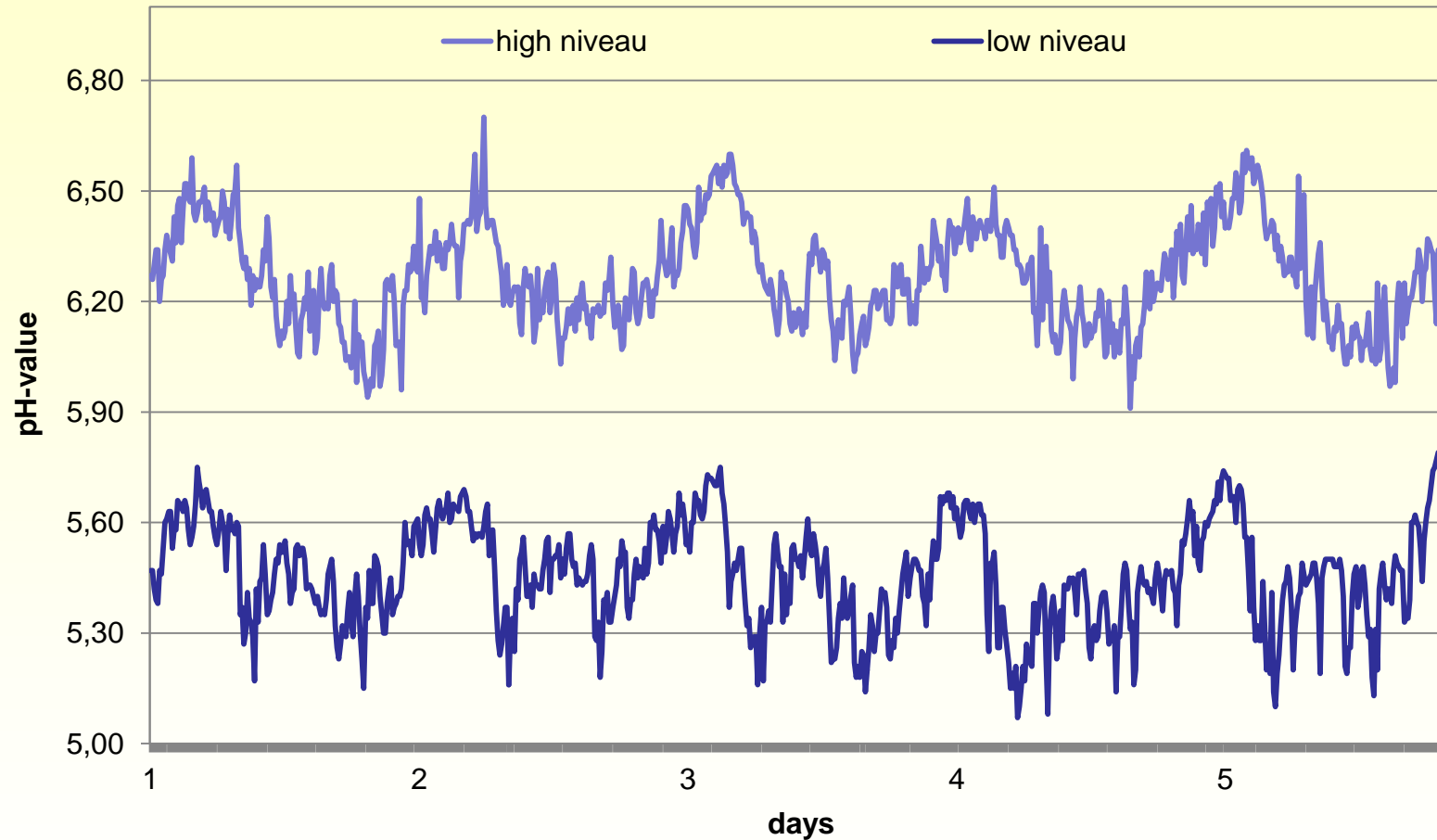
Radiotransmission of Data
(pH and temperature)



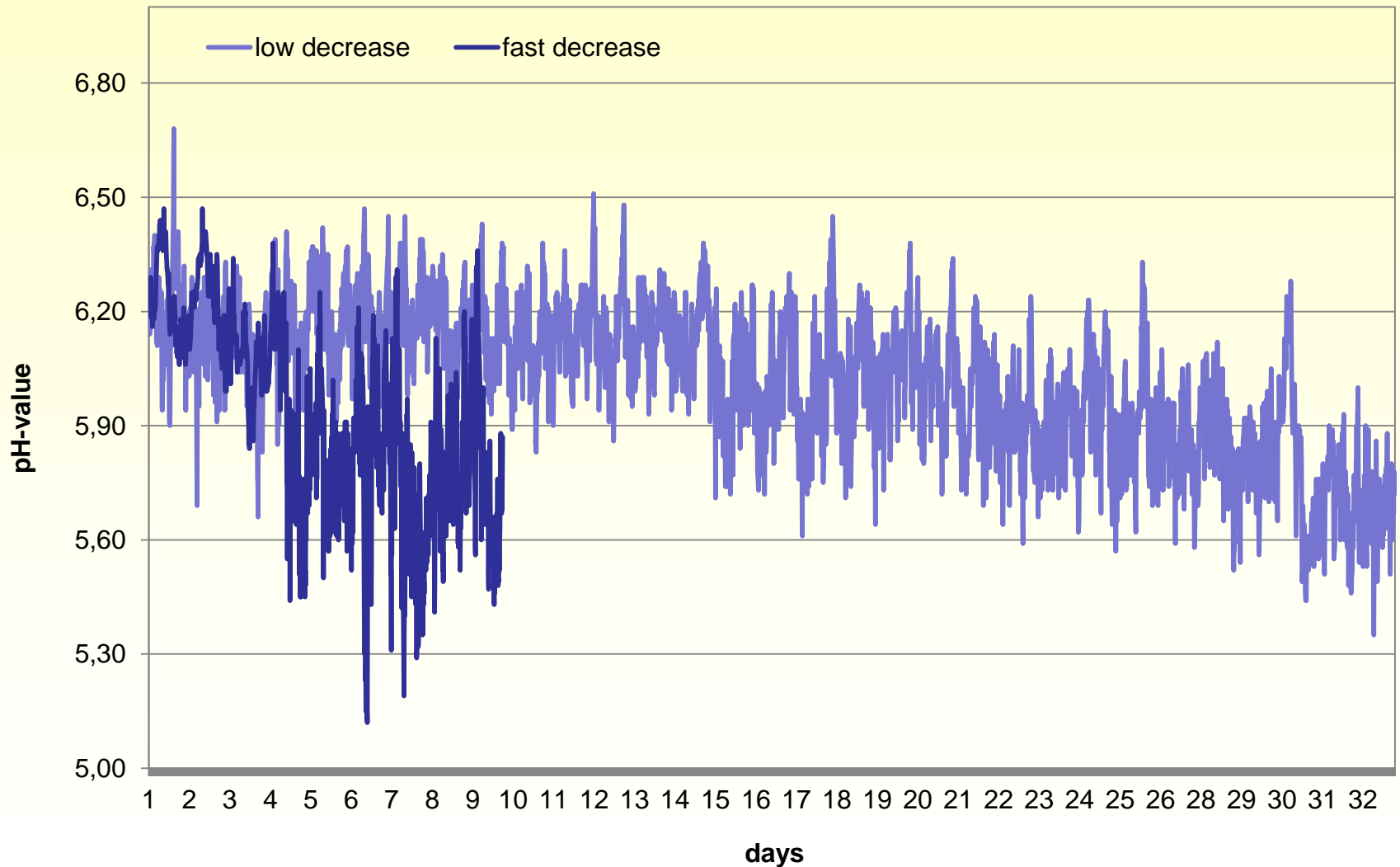
Example for long term measurement with pH-sensor



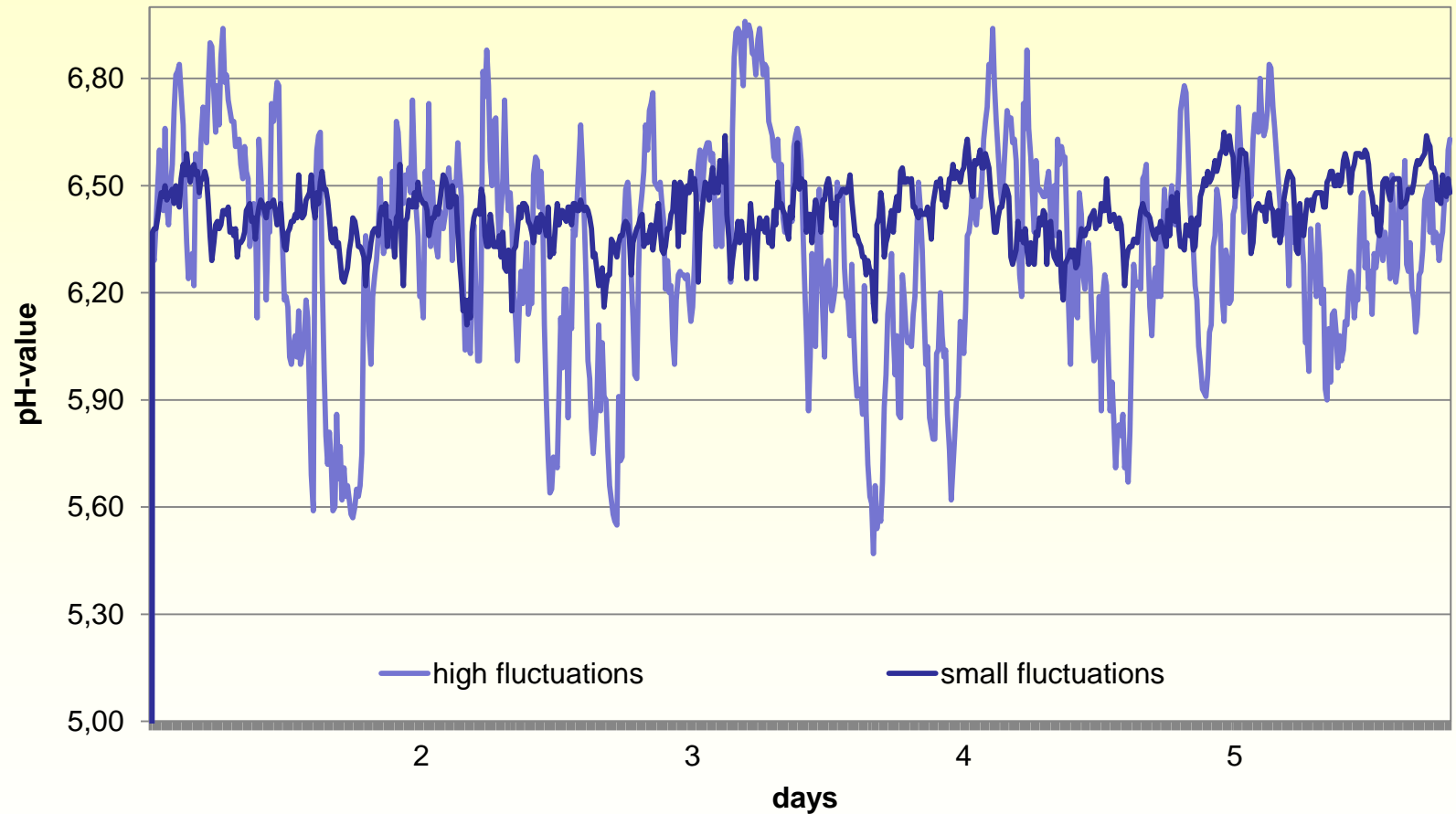
Results: Interpretation pH-Niveau



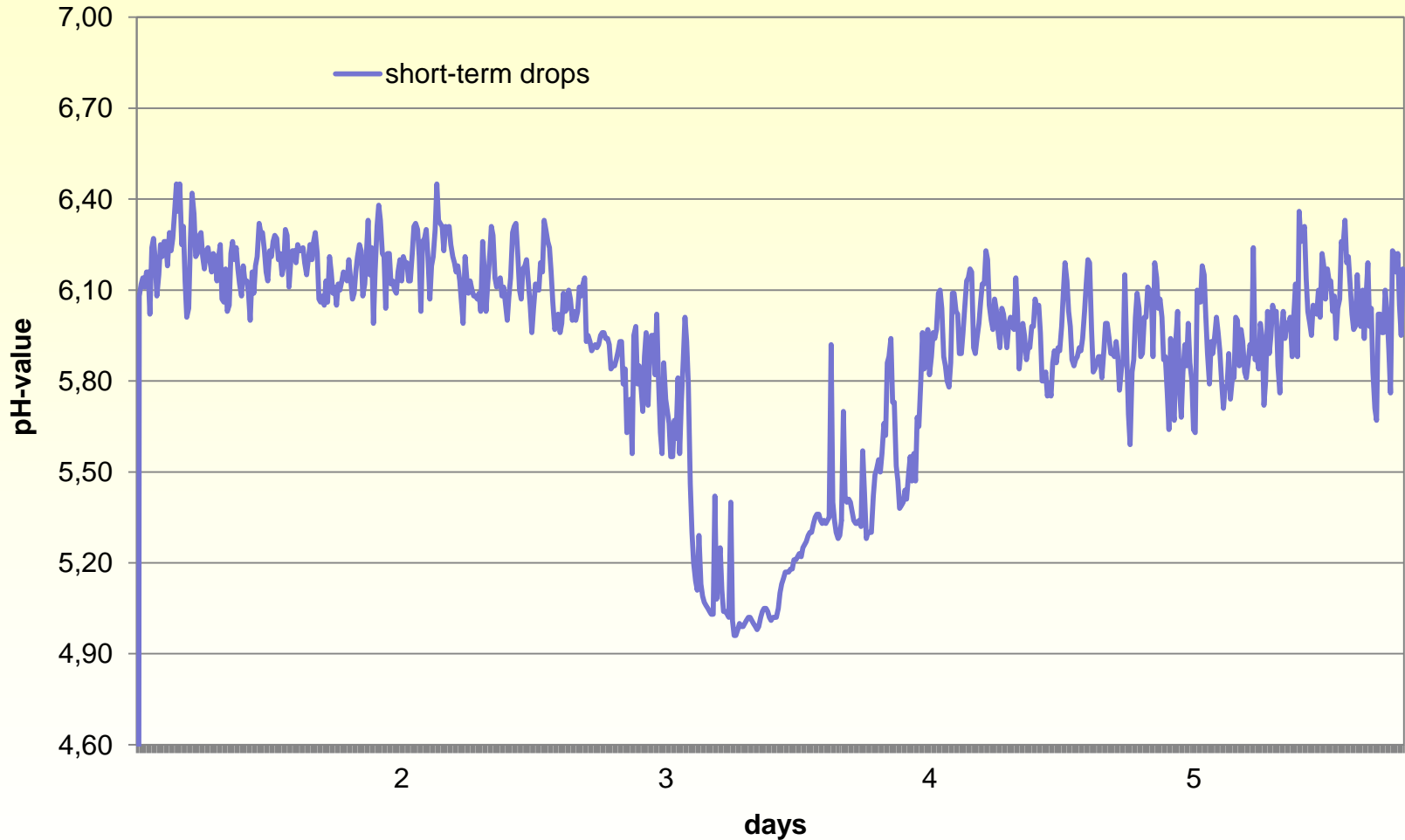
Results: Interpretation pH-decrease



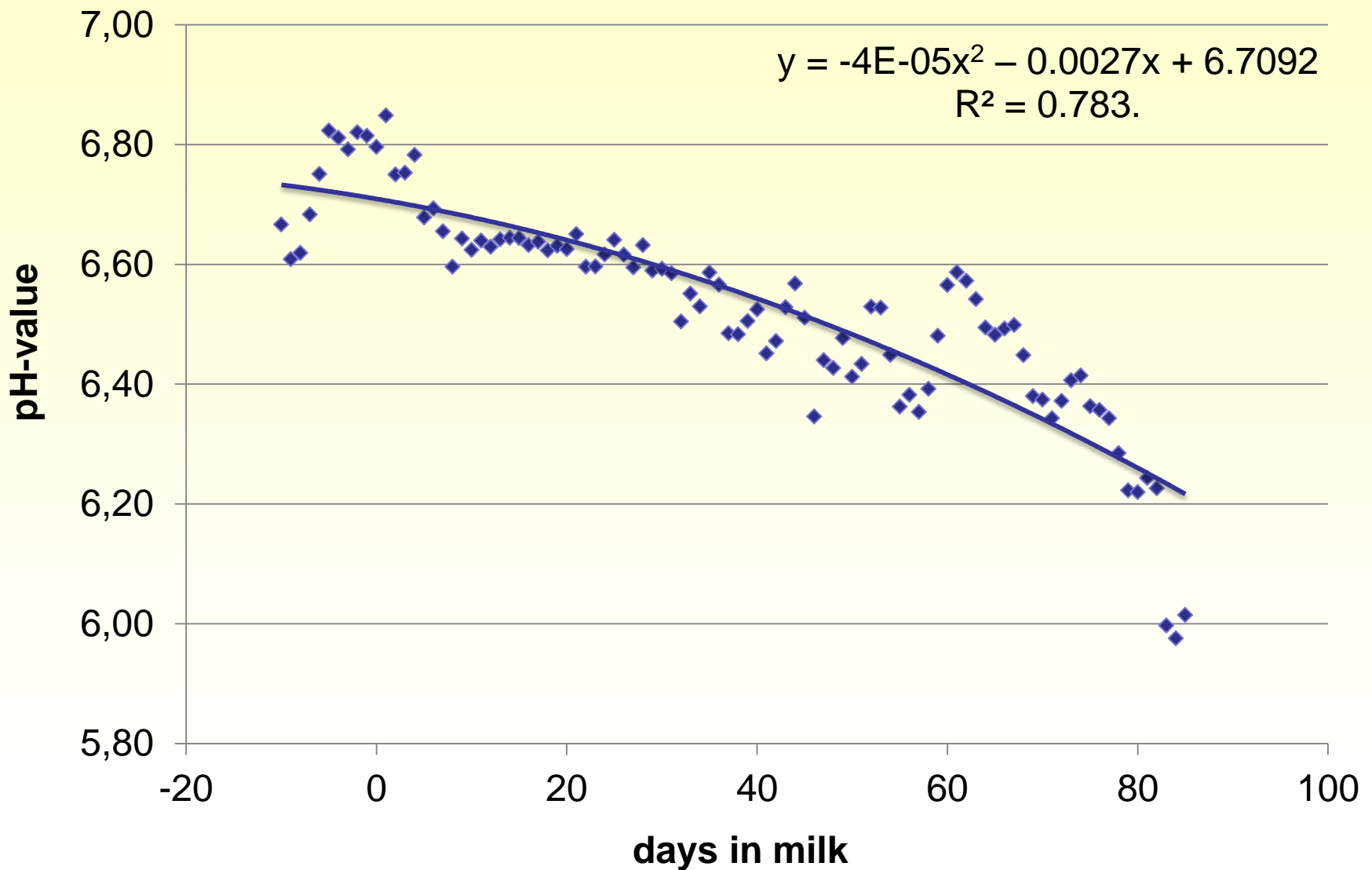
Results: Interpretation pH-fluctuations



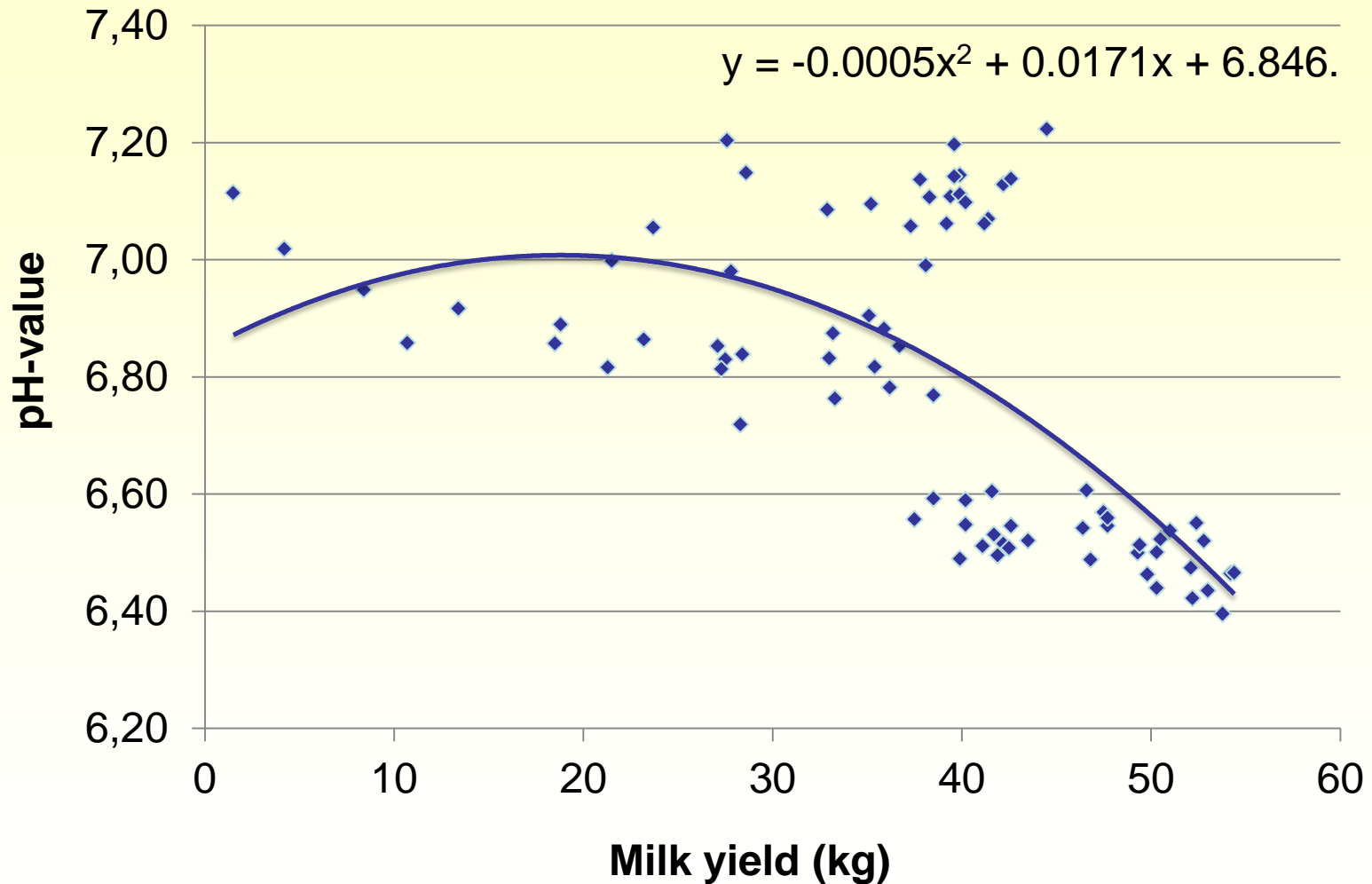
Results: Interpretation pH – short-term drops



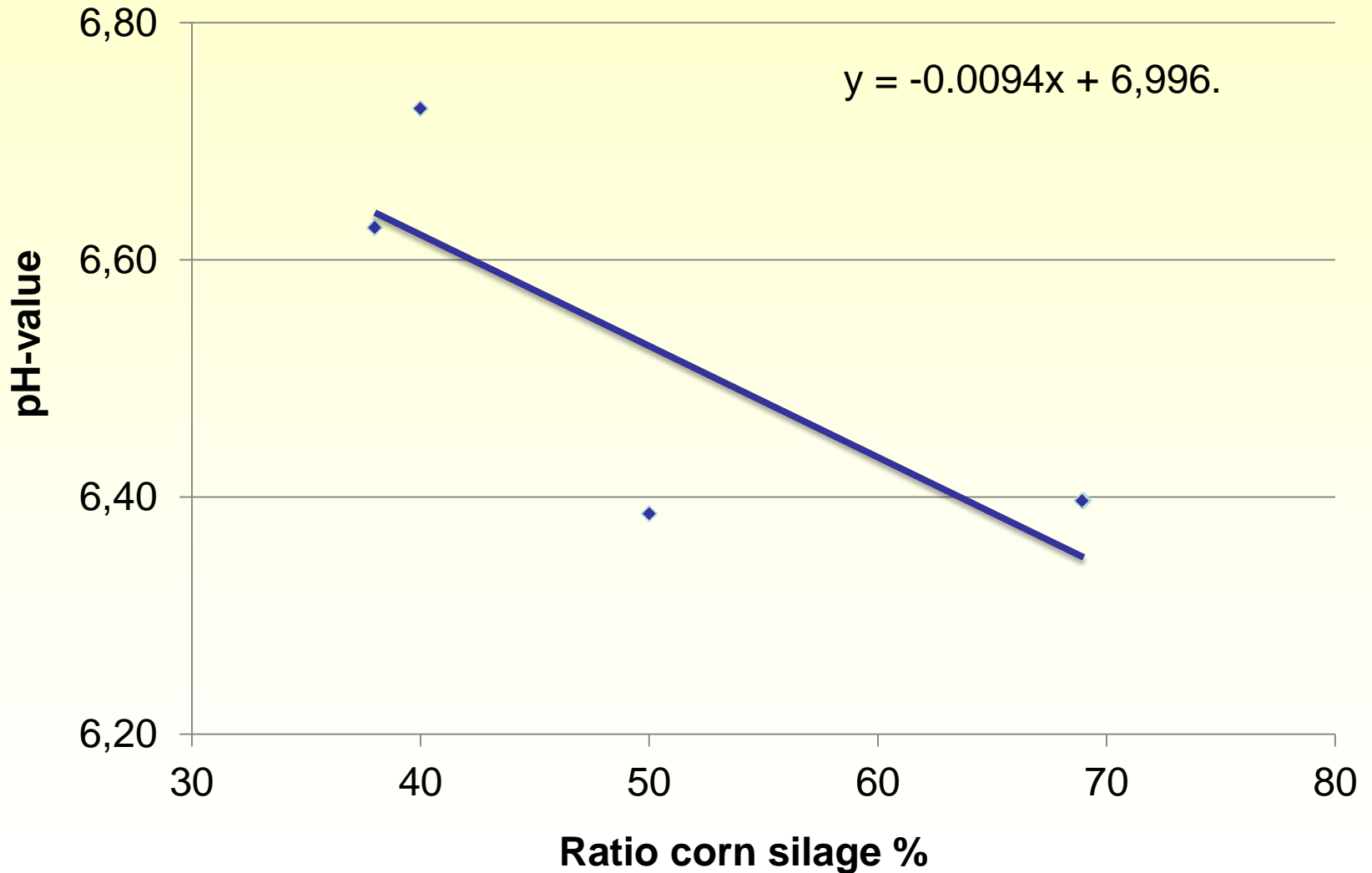
Results: Correlation pH-value with days in milk (DIM)



Results: Correlation pH-value with milk yield



Results: correlation pH-value with percentage corn silage



Results

- **Ruminal pH was influenced by**
 - **Fed ration (DMI, starch and fibre content)**
 - **Day of lactation (DIM)**
 - **Milk yield**
- **Interpretation of data:**
 - **pH – Niveau**
 - **pH – Fluctuations**
 - **pH – Decrease (time)**
 - **pH – short-term drops**

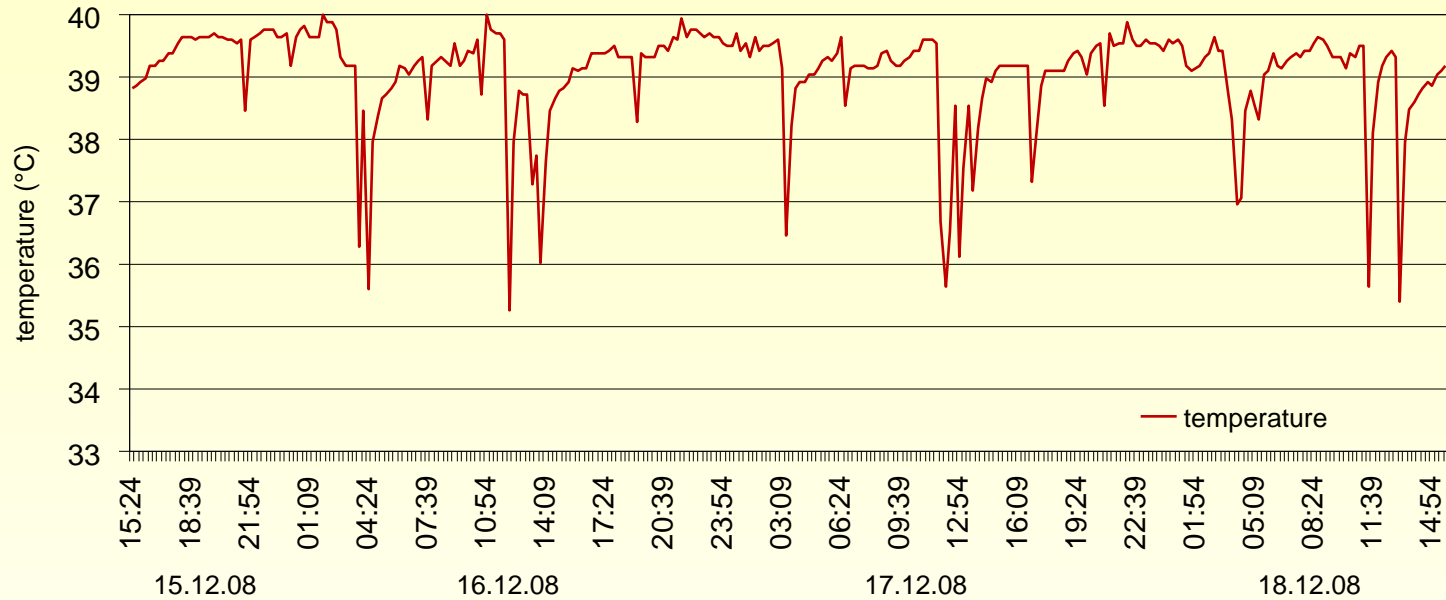
Summary

- **Ruminal pH is a reflection of the fed ration and of the feeding management—visible by continuous measurement**
- **Determination of changes of ruminal pH in time allows an accurate definition of ruminal acidotic load and to evaluate fed rations**
- **Introduced pH probe is a helpful tool for scientific questions dealing with rumen acidosis, as..**
 - Feeding different levels concentrates
 - Pasture and rations with low fibre
 - Use of drugs to neutralize rumen acidosis
- **Practical use on farms**
 - Is in process (Europe)
 - Future Management Tool in high yielding dairy herds



Thank you

Interpretation ruminal temperature



Ruminal Temperature is depending on:

- Temperature of feed stuff
- Temperature of water
- Ambient temperature – summer – winter – direct insolation
- Rations energy content fiber content
- Correlation with body temperature, but complex software necessary