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Experience with Bovine Electronic Identification in Germany

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Contents

- introduction
- results of some selected studies from research units in Germany
- results of a farm project in North West Germany
- economic aspects
- conclusion

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Design of Different Electronic Identification Systems on Animals

- bolus
- injectable transponder
- electronic ear tag

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Requirements on Electronic Identification Systems

- ISO 11784
  Radio frequency identification of animals -- Code structure
- ISO 11785
  Radio frequency identification of animals -- Technical concept

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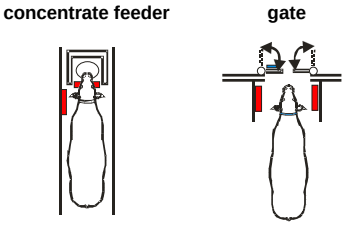
Different Processes of Identification

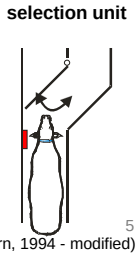
Static Process

- animal is standing in a room, slow movement
- easy definition of head and rump position
- scanning distance: 0.3 to 0.5 m
- scanning speed requirements: low / middle
- examples: calf feeder, concentrate feeder



Dynamic Process

- animal is moving
- head and rump position are difficult to define
- scanning distance: 0.5 to 0.9 m
- scanning speed requirements: high (cow speed: ~ 3 m/s)
- examples: selection unit, walk through detection, milking parlour



actual places for installing the identification scanner

(Prinkelmann and Kern, 1994 - modified)

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Comparison Between Different Identification Systems

feature	bolus	injectable	electronic ear tag
application	+	(+)*	++
scanning (hand held device)	-	+	++
scanning process control syst.	+ / -	+	++
withdrawal (abbattoir)	+	-	++
lost identification systems	++	++	+
data protection	+	+	+
assessment	++ very positive + positive - negative * only trained staff		

(IDEA, 2002 - modified)

Study 1: Combination with Biometric Sensors

Correlation between automatic messured body and rectal temperature (Injectable Transponder)

- methods
  - calves, 2 – 11 weeks pp.
  - transponder with integrated temperature sensor, injected near the ear (*ventral to Scutulum*)
  - recording the rectal temperature “by hand“
- results
  - high correlation: 0.82
  - differences in 2nd week: 1.5 K
  - differences later: 1.0 K

(Kamann et. al., 1999)

Study 1: Combination with Biometric Sensors

Correlation between automatic messured body and rectal temperature (Injectable Transponder)

- detailed analysis: modified methods
  - controlled artificial hyperthermy
- results
  - high correlation between increasing and decreasing body temperatur (injectable transponder vs. rectal temperature): 0.82

(Kamann et. al., 1999)

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Study 2: Combination with Biometric Sensors

Correlation between automatic messured body and rectal temperature (Bolus)

- methods
  - 5 calves, 2 weeks old
  - bolus with integrated temperature sensor (prototype), located in the *Reticulum*
  - recording 2 times a day (morning / afternoon) at the same time
    - bolus body temperature by hand reader
    - rectal temperature “by hand“

(Klintworth et. al., 2006)

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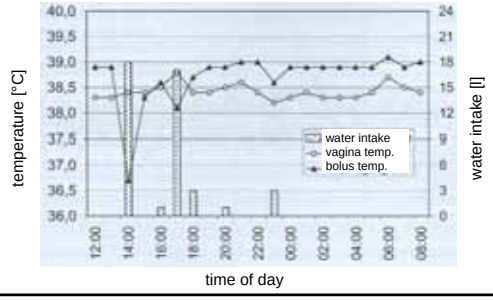
Study 2: Combination with Biometric Sensors

Correlation between automatic messured body and rectal temperature (Bolus)

- results
  - (high) correlation: 0.74 (Klintworth et. al., 2006)
  - correlation depending on water intake (Klintworth, 2004)

1 cow, 1 day:



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Reasons

- withdrawal (abb
  - question of c
    What happer
    finding a bolu
    in his meat /
- TID = VID
  - technical ide
  - visual identifi

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Periode 1: 2 Hardware Components under Experimental Conditions

- methods
  - 80 cows, additionally their calves
  - ISO 11784 compatible ear tags
  - August 2003 – July 2004
  - automatic digital balance
    - static process of identification
    - reader TL-01 ISO (Texas Trading), ISO 11785 compatible
    - aim of study:
      automatic animal identification
      and weighning

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Periode 1: 2 Hardware Components under Experimental Conditions

- hand reader
  - reader HL-01 (Texas Trading), ISO 11785 compatible
  - data interface to a common PDA (HP iPAQ 5550)
  - aim of study :
    - automatic animal identification
    - data messages to the national I&R data base via PDA (birth, arrival, departure, death)

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Periode 2: Several Hardware Components in Parallel Operation under Practical Conditions

- methods
  - 388 animals (cows, heifers and calves)
  - ISO 11784 compatible ear tags
  - July 2005 – December 2006
  - automatic digital balance (see periode 1)

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Periode 2: **Several Hardware Components in Parallel Operation under Practical Conditions**

- calf feeder
  - static process of identification
  - reader T2S HDX V01 TIRIS (Texas Trading), not ISO 11785 compatible
  - aim of study: automatic animal identification and amount of assimilated drinks

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Periode 2: **Several Hardware Components in Parallel Operation under Practical Conditions**

- concentrate feeder (2 units)
  - static process of identification
  - reader DMS 21 ID HDX/FDX-B (Nedap), ISO 11785 compatible
  - aim of study: automatic animal identification and allocating an animal specific concentrate amount

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Periode 2: **Several Hardware Components in Parallel Operation under Practical Conditions**

- selection unit
  - dynamic process of identification: “walk through“
  - pre-identification unit
    VC4 Single Plus
    DMS 21 HDX/FDX (Nedap)
  - reader
    Twin Plus SF 4 ISO HDX/FDX – B (Nedap)
  - aim of study:
    automatic animal identification and selecting animals in different groups

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Periode 2: **Several Hardware Components in Parallel Operation under Practical Conditions**

- walk through detection (2 units)
  - dynamic process of identification: “walk through“
  - reader
    Full ISO Reader
    HDX/FDX – B
    (Botec)
  - aim of study:
    automatic animal identification

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

General Results

- delivery time of electronic ear tags
  - 1st order: max. 7 days
  - reorder: max. 10 days
- 1st test of electronic ear tags before application: hand reader
  - test OK: 556 ear tags (99.64 %)
  - deficient: 2 ear tags (0.36 %)

Study 3: Use of Electronic Ear Tags in an Experimental Farm

General Results

- no. of lost ear tags

	electronic ear tag	plastic ear tag
ear tags applied	558	796
ear tags lost	5	45
quota	**0.9 %**	**5.6 %**

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Results of Periode 1

- A combination of commercial hardware is possible.
- Data exchange with the national data base is possible and works without problems.

unit	no. of readings	detection correctly (%)
automatic digital balance	1,180	100.0
hand reader	5,008	100.0

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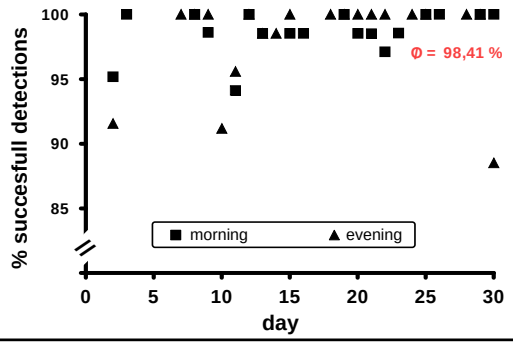
Study 3: Use of Electronic Ear Tags in an Experimental Farm

Results of Periode 1

- modified experiment:
  automatic digital balance as “walk through detection“



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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Results of Periode 2

unit	detection		Notes
	no.	%	
automatic digital balance	16,332	99.8	power supply, humidity
calf feeder	83,808	100.0	only HDX
concentrate feeder	202,498	100.0	
selection unit	3,875	78.0	***)
walk through detection	2,434	49.0	***)

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Study 3: Use of Electronic Ear Tags in an Experimental Farm

Results of Periode 2

Study 3: Use of Electronic Ear Tags in an Experimental Farm

Results of Periode 2

unit	detection		Notes
	no.	%	
automatic digital balance	16,332	99.8	power supply, humidity
calf feeder	83,808	100.0	only HDX
concentrate feeder	202,498	100.0	
selection unit	(3,875)	(78.0)	***)
	34,776	100.0	
walk through detection	(2,434)	(49.0)	***)
	9,936	99.9	adaption necessary

Economic Aspects of Using Electronic Ear Tags

Replaced Plastic Ear Tags in Lower Saxony

year	registered cattle	applicated ear tags	replaced ear tags	%
2001	2,827,016	5,654,032	679,899	12.03
2002	2,719,416	5,438,832	697,046	12.82
2003	2,661,117	5,322,234	497,065	9.34
2004	2,586,887	5,173,774	347,610	6.72
2005	**2,561,585**	**5,123,170**	**289,698**	**5.65**

(http://cdl.niedersachsen.de/blob/images/C25574155_L20.pdf; own results, 2005 – not published)

- If each cattle is registered with 1 plastic and 1 electronic ear tag,
  - ca. **0.5 x 300.000 = 150,000** plastic ear tags has to be replaced,
  - ca. **24,000** electronic ear tags has to be replaced potentially.
    = ([5.65 % x (0.90 %)$^{-1}$]$^{-1}$ x 0.5 x 300,000)

Economic Aspects of Using Electronic Ear Tags

Costs of Replacing an Ear Tag

- costs of replacing an plastic ear tag 11.22 Euro
  - controlling and booking: 0.30 Euro
  - fabrication and logistics of an replacement ear tag: 0.92 Euro
  - time and effort for the farmer (application): 10.00 Euro
- costs in Lower Saxony: 300,000 x 11.22 Euro = 3,366,000 Euro
- Which reduction of cost can be achieved, if the number of replacement ear tags is decreasing to 150,000 plastic + 24,000 electronic ear tags?
- not included: - benefits at abbattoirs and other cattle collecting points,
  - benefits because of decreased number of accidents concerning ear tag application

Conclusion

- Identification of bovine animals with electronic ear tags is easy and reliable.
- Integration of electronic ear tags and readers into the on-farm production engineering is possible and reliable to operate.
  - technical synchronisation of different systems is necessary!
- Input for administration, farm management and work flow can be reduced using electronic animal identification systems.
- Integration of electronic ear tags is the next step
  - to automize the data management on farm;
  - to automize and the data exchange between business partners.

Conclusion

- Concerning all costs and savings, electronic ear tags are not automatically more expensive than plastic ear tags.
- Further developments of RFID technologies can lead to get more information about animals.
  - sensoric mesurement of temperature, pH, etc.
  - relevant to practice?
  - cost-benefit ratio?
  - at the moment only via bolus or injectable tranponder
- The continuous data flow between different systems (process control, management software, data base software) makes more standardization of data interfaces, formats and algorithms necessarily, especially on international level.