# Experience with bovine electronic identification in Germany

*B. Eggers*[1]*, N. Wirtz*[1]*, D. Albers*[2] *& R. Reents*[1]

[1]*Vereinigte Informationssysteme Tierhaltung w.V. (vit), Heideweg 1, 27283 Verden, Germany*
[2]*Landwirtschaftskammer Niedersachsen, Sarver Straße 39a, 26954 Nordenham, Germany*

## Summary

Different studies in Germany and Europe investigated in electronic identification systems for animals. The IDEA-project compared different electronic animal identification systems from a technical point of view.

Both, bolus and injectable transponders can be combined with biometric sensors simpler than ear tags. This combination is useful to get information about hyperthermy. Bolus and injectable transponders are preferred by universities and other experimental institutions.

However, farmers and industry prefer electronic ear tags compared with bolus and injectable transponders, because they are easier to handle. In practice, ear tags can be applicated by non trained staff. Ear tags are also easier to integrate in practical farming operations.

The number of disappeared electronic ear tags is distinctly lower than the number of lost normal visual ear tags. The involvement of electronic ear tags in automatic identification of animals and in transferring data processes in practical farming is ready to put into practice. The number of disappeared electronic ear tags compared with visual ear tags is lower. So, there are less costs for ordering and replacing lost tags.

Electronic ear tags can be used in practical farming at different places to identify animals. Concerning all costs and savings it seems to be more efficient to use electronic ear tags than normal visual eartags.

***Key words***: *RFID, Electronic tagging, Electronic identification, Transponder, Bolus, Injectable, Ear tag, Precision farming, Biometric sensors.*

## Introduction

Electronic identification systems can be classified as bolus, injectable transponder or electronic ear tag. All these different systems have to follow an international standard. In the field of animal identification, the international standards are ISO 11784 (Radio frequency identification of animals – Code structure) and ISO 11785 (Radio frequency identification of animals – Technical concept). If people are talking about ISO compatible identification systems, they are talking about systems applying these two standards.

The IDEA project compared different electronic animal idenitication systems regarding the application, the scanning quality, the withdrawal at abbattoir, the number of lost identification systems and the data protection (IDEA, 2002). Table 1 shows that electronic ear tags have a lot of advantages. Only in the number of lost systems, bolus and injectable transponders are more reliable. Because of these reasons electronic ear tags are prefered by farmers and industry, whereas bolus or injectable transponder are prefered by universities and other experimental institutions.

Different processes of idenfication can be classified, too (Prinkelmann and Kern, 1994). At the static process the animal is standing or is moving slowly in a room. It is more or less easy to define the head or rump position of the animal. The scanning distance is around 0.3 to 0.5 m. The scanning speed requirement is low up to middle. At the dynamic identification process the animal is moving, and it is more difficult to define head or rump position. The scanning distance is around 0.5 to 0.9 m. The scanning speed requirement is high, and it is necessary to identify also cows which can achieve a speed of 3 m/s.

The current paper gives an overview about some German studies investigating in electronic cattle identification systems.

*Table 1. Comparison between different electronic identification systems (IDEA, 2002, modified).*

| Feature | Bolus | Injectable transponder | Electronic ear tag |
|---|---|---|---|
| Application | + | +[1] | ++ |
| Scanning (hand held device) | – | + | ++ |
| Scanning process control syst. | +/– | + | ++ |
| Withdrawal (abbattoir) | + | – | ++ |
| Lost identification systems | ++ | ++ | + |
| Data protection | + | + | + |

+ + Very prositive.
+ Positive.
– Negative.
[1]Only trained staff

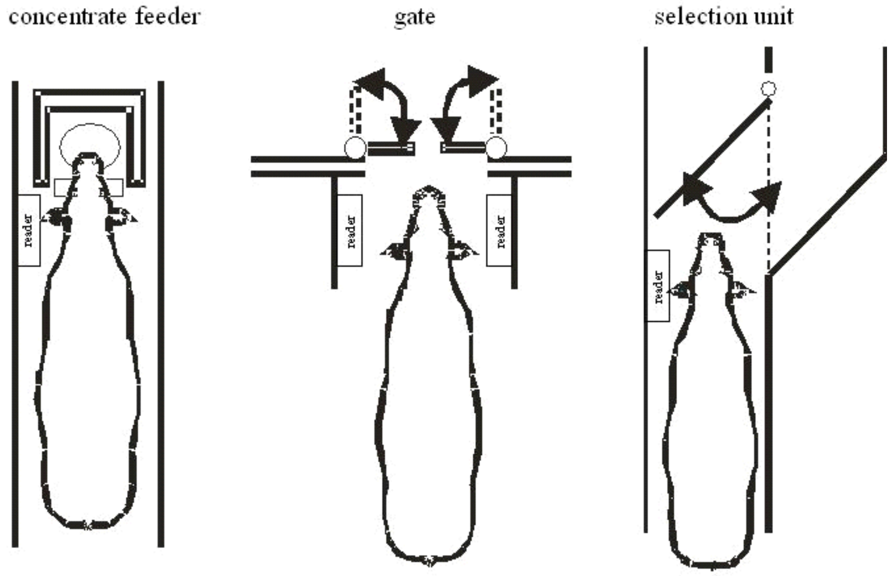


*Figure 1. Different processes of animal identification (Prinkelmann and Kern, 1994, modified).*

## Material and methods - Study 1

Calves were applied with injectable transponders near the ear, ventral to Scutulum. The injectables were equipped with integrated temperature sensors. Between 2 and 11 weeks pp. the temperature messured by the injectable was transferred to a hand reader. At the same time the rectal temperature was messured by hand using a common thermometer.

As second step, the methods were modified: to get more detailed information, a controlled artificial hyperthermy was started (Kamann *et al*., 1999).

## Study 2

5 calves were applicated with bolus systems, located in the Reticulum. The id systems were equipped with integrated temperature sensors (prototype). Two times a day, in the morning and in the afternoon, the bolus temperature was messured by data transfer to a hand reader. At the same time, the rectal temperature was messured by hand using a common thermometer (Klindtworth *et al*., 2006).

## Study 3

The first period of the study called ITeK-Rind (innovative technologies in electronic tagging of cattle) dealt with 2 hardware components under experimental conditions. 80 cows and their calves born in the study periode between August 2003 to July 2004 were applicated with electronic ear tags. The animals were weighed at an automatic digital balance. The aim of the study was both to identify the animals and to weigh them automatically. A second hardware component was a hand reader. Here, the aim was to identify the animals automatically and to transfer data messages to the national I&R data base via PDA (birth, arrival, departure, death).

The second period of this study ran from July 2005 to December 2006. The aim of the study was to investigate the management and practicality of several hardware components in parallel operation under practical conditions. 388 animals (cows, heifers and calves) were applicated with electronic ear tags. The hardware components were: a automatic digital balance (see periode 1), a calf feeder, 2 concentrate feeders, a selection unit, and 2 walk through detections (Albers, 2007).

## Results and discussion - Study 1

A correlation of 0.82 between the temperature values messured by the injectable transponder and messured by a common thermometer shows that the automatic messured temperature is a quite good indicator for hyperthermy or hypothermy. But also differences between both methods were found. In average, the transponder temperature was 1 K lower than the rectal temperature. In the second week pp. the difference of 1.5 K was even higher than in the weeks after. A reason was found in the influence of the outside temperature. Because there was not so many tissue between the transponder and the air outside, the temperature messured by the transponder was lower (Kamann *et al*., 1999).

When a controlled artificial hyperthermy was implemented, a correlation of 0.82 between injectable and rectal temperature was found regarding the increasing and decreasing body temperature (Kamann *et al*. 1999).

### Study 2

The correlation of 0.74 between bolus temperature and rectal temperature was also high (Klindtworth *et al*., 2006). But bolus temperature has to be corrected when animals are drinking water. A former experiment showed the high influence of water intake (Figure 2). The bolus temperarture was reduced when the animal drank a lot of cold water. Because of the application in the Reticulum the bolus temperature was influenced in these cases (Klindtworth, 2004).

### Study 3

558 electronic and 796 conventional ear tags were applicated in both periodes. 2 electronic ear tags (0.36%) had a malfunction at a first test before applicating. 5 electronic ear tags (0.9%) and 45 conventional ear tags (5.6%) disappeared during the study.

A combination of a hand reader and a commercial PDA is possible. The data exchange with the national I&R data base worked without any problems. 5 008 readings with the hand reader and 1 180 readings of the automatic digital balance were carried out in the first periode, in both cases 100.0% of all detections worked correctly. When modifying the automatic digital balance as a walk through detection, 98.41% of all detections were successful.

Table 2 describes the result of the second periode. The automatic digital balance, the calf feeder, the concentrate feeders, the selections unit, and the walk through detections worked well with a detection rate of 99.8, 100.0, 100.0, 100.0, and 99.9%, respectively. But the detection rate was reduced at selection unit and walk through detections up to 78.0 and 49.0%, when these devices worked in parallel operation without a synchronisation. In spite of a distance of 12 m between these units (twice the distance as in the manual denoted), the two devices influenced each other’s detection. Working in separate operation, the detection rate was high (Albers, 2007).

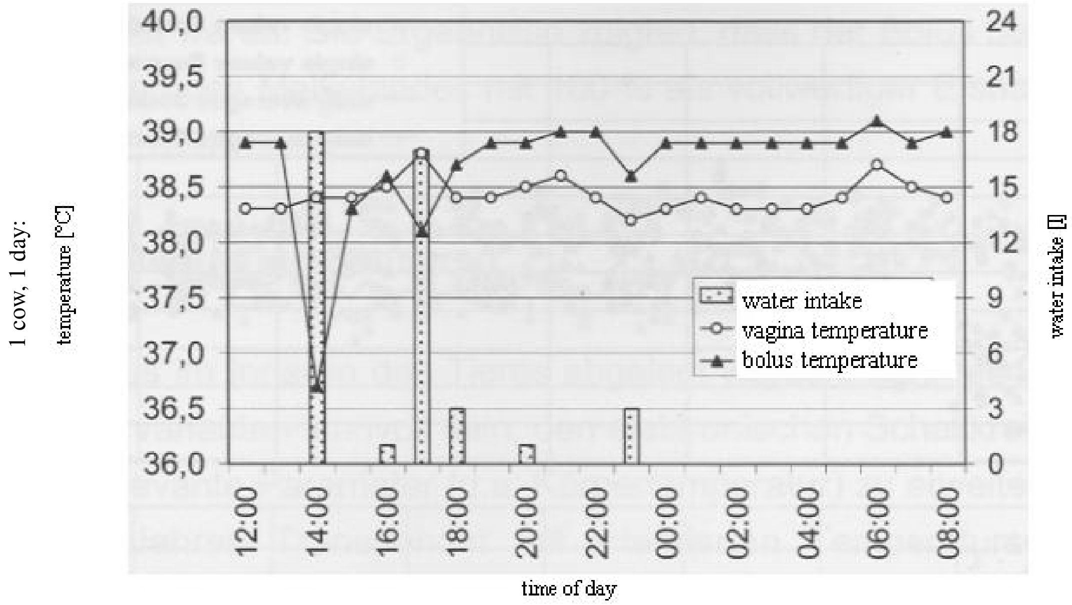


*Figure 2. Water intake, bolus temperature and vagina temperatur of one representative cow (Klindtworth, 2004).*

*Table 2. Detection rates in period 2 of study 3.*

| Unit | No. detection | % detection | Notes |
|---|---|---|---|
| Automatic digital balance | 16 332 | 99.8 | Power supply, humidity |
| Calf feeder | 83 808 | 100.0 | Only HDX |
| Concentrate feeders | 202 498 | 100.0 | |
| Selection unit | 34 776 | 100.0 | (78.0% detection rate) |
| Walk through detection | 9 936 | 99.9 | (49.0% detection rate) |

**Economic aspects using electronic ear tags**

Table 3 prestents the number of replaced conventional plastic ear tags in the region of Lower Saxony. Between 2001 and 2005 the number of replaced ear tags decreased as well as the ratio between replaced ear tags and applicated ear tags. In 2005 this ratio was 5.65% and as high as the ratio of replaced conventional plastic ear tags of study 3 (5.6%).

Replacing one conventional plastic ear tag with an electronic ear tag, the number of replaced ear tags can be reduced. Study 3 demonstrated that the ratio of replaced ear tags can be reduced from 5.6% to 0.9%. The number of replaced ear tags can be reduced to 58.0% of the two conventional plastic ear tag scenario:

$0.5 \times T + 0.5 \times [0.056 \times (0.009)^{-1}]^{-1} \times T = 0.58 \times T$

where T is the number of replaced ear tags when both tags are conventional).

*Table 3. Replaced plastic ear tags in Lower Saxony between 2001 and 2005. (http://cdl.niedersachsen.de/blob/images/C25574155_L20.pdf; own results, 2005, not published)*

| Year | Registered cattle | Applied 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 |

Due to the high labor cost in Germany, it makes sense to reduce the number of replaced ear tags. Additionally, benefits are expected if manual work can be reduced using automatic reader at big cattle collection points like abbattoirs or collection stations for animal export. Concerning all costs and savings, it is difficult to calculate the benefits of decreased number of accidents regarding ear tag application.

## Conclusion

Electronic identification of bovine animals is possible. Identification 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, but a technical synchronisation of different systems is necessary. Input for administration, farm management and work flow can be reduced using electronic animal identification systems. The integration of electronic ear tags is the next step to automize the data management on farm and the data exchange between business partners. Concerning all costs and savings, electronic ear tags are not automatically more expensive than plastic ear tags.

Further developments of RFID technlogies can lead to get more information about animals. The combination of an identification system and sensoric messurement (temperature, pH, etc.) are interesting both for practical farmer and for experimental barns. At the moment, these combinations can only be carried out using bolus or injectable transponder. But using electronic ear tags is more practicable on farm and on abbattoirs.

Furthermore, the continuous data flow between different systems (process control, management software, data bases) makes more standardization of data interfaces, formats and algorithms necessarily, especially on international level.

## List of references

**Albers, D**. 2007. Erfahrungen mit elektronischen Ohrmarken in Niedersachsen – Projekt ITeK-Rind. In: Ministry of Nutrition, Agriculture and Forest (editor), Proceedings of the 1st National Meeting Elektronische Tierkennzeichnung in der Landwirtschaft, Fulda.

**IDEA**. 2002. Identification électronique des animaux. Joint Researche Centre of the European Commission. Final report, Version 5.2.

**Kamann, B., K. Klindtworth, G. Wendel, W.D. Kraetzel, H. Schön and J. Hartung**. 1999. Automatische Gesundheitsüberwachung mit Hilfe von injizierbaren Temperaturtranspondern in der Kälberaufzucht. In: Landtechnik Weihenstephan (editor), Proceedings of the 4th International Meeting Bau Technik und Umwelt in der landwirtschaftlichen Nutztierhaltung, 249-254.

**Klindtworth, M**. 2004. Von der elektronischen Tierkennzeichnung zum Gesundheitsmanagement. VDI-Max-Eyth-Gesellschaft (editor), VDI-Berichte 1865, 123-138.

**Klindtworth, M., H. Kätker, K. Markmann and H. Jürgens**. 2006. Untersuchung verschiedener Temperaturmessverfahren beim Kalb. Project thesis, University of Applied Sciences Osnabrück.

**Prinkelmann, H. and G. Kern**. 1994. Einsatzerfahrungen mit injizierbaren Transpondern in der Rinderhaltung. In: KTBL-Arbeitspapier 258, Injektate zur elektronischen Tieridentifizierung, KTBL Darmstadt, 96-100.