Rus, Mihaiela Alexandrina and Kaufmann, Otto

Sensor based analysis of feeding behaviour of fattened pigs

In research and in practice sensor-based systems are increasingly used to assess the reaction of animals. A research project analysed the behaviour of pigs concerning different elements of the husbandry system. The pigs were fed by a automatic feeder (with pelted food) which recorded the feed intake, the visit duration and the visit frequency for each animal. The pigs of different genotype showed considerable differences in their feeding behaviour. The feeding area was located in a open run outside the resting area and therefore had outdoor climatic conditions. Low outdoor temperatures (around 0°C) did not influence the feeding behaviour.

Keywords
Sensor based analysis, feeding behaviour, fattening pigs

Abstract
Landtechnik 64 (2009), no. 2, pp. 109 - 111, 3 figures, 2 tables, 2 references

Presently is controversially discussed in Germany the introduction of a test procedure and allowance procedure for stable equipment and housing systems.

With the use „tested and allowed technology“ the quality of the animal husbandry is supposed to be improved. This arouse the question about the test methods. Already existing voluntary tests (DLG), based on technical parameters. But to assess animal welfare on the farm level, the reactions of the animals to the husbandry technology must be analysed. Thereto sensors can be integrated into the „test-systems“. These sensors can analyse the animal behaviour and thereby provide a wide data-base for the analyses. The following results are a part of large research project which analyzes the response of pigs on different housing systems to segment of these systems [1].

They refer to the behaviour of pigs of different races by feeding with pelted food. The sensor-based identification allowed registration of the feeding duration, the feeding rate and the feeding frequency throughout the whole fattening period. Moreover the influence of the outdoor temperature on feeding behaviour and the feed intake was examined.

Material and Methods

The investigations were carried out in a plant, that consists of two climate controlled resting areas (A and B) and a feeding area C (open run) **(Figure 1)**.

The feeding area „C“ is provided with two automatic feeders (F1 and F2) and two drinkers (W5 and W6) which are equipped with animal identification facilities.

The automatic feeders measure feeding time, feed intake and its duration of each animal. At the drinkers, the duration of stay of pigs is also recorded.

Each identification of pigs by entering or leaving the resting areas or by using the feeders and drinkers was transmitted by the data line to a PC and was stored.

The individual electronic identification of the pigs is provided by ear-responder. Moreover this electronic identification at passage gates are enables to record the visit duration in the resting area.

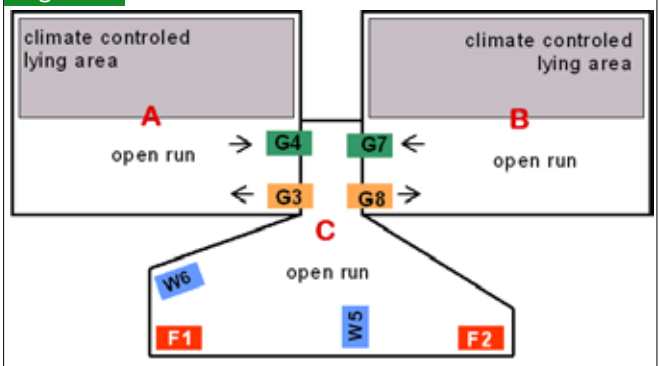
The presented results are based on parameters of overall 20 pigs of different races (Sattelschwein, Deutsche Landrasse and Duroc) which were recorded over the whole fattening period. The pigs were weight at the beginning and the end of the research and during the fattening period once a week. The statistical data-analysis was calculated by using the program system SPSS for Windows, Version 15.0.

Fattening efficiency and feeding behaviour

At the beginning the animals had an average weight of 26.9 kg live weight. The fattening period ended after 102 days with an average weight of 111.2 kg **(Tab. 1)**. The average daily gain was 818.6g. The feed conversion over the whole fattening period was 3.16 kg per kg gain.

The analyses of the feeding behaviour over the whole duration of the experiment showed that the animals visited the feeders 11.14 times in average daily. The average feeding duration over the whole fattening period was approximately 69 min per animal and day. With an average daily feed intake of 2.61 kg the animals had and average feeding rate of 39g per minute. The feed intake and the feeding behaviour differ between pigs of different races [2]. Concerning the fattening efficiency (daily

Fig. 1



Experimental design

F Feeder
W Drinker
T Pasage gate (Entrance)
T Pasage gate (Exit)

gain and feeding conversion) the Sattelschwein pigs, expectably achieved worse results than the pigs of the other two races. **Table 2** provides information about this differences.

The genotypes differ significantly in their feeding behaviour. The animals of the race Duroc have a significantly lower daily feeding frequency (8.5) than the animals of the other two groups (Deutsche Landrace – 12.3 and Sattelschwein – 12.1). The Sattelschweine pigs have the longest daily eating time (nearly 80 minutes), followed by the Duroc pigs (67 minutes). The animals of the Deutsche Landrace spend the smallest time with feed intake (62 minutes). The both „intensive-races" Duroc and Deutsche Landrace had a feeding rate which was 20% faster than the one of the Sattelschweine pigs.

Over a period of two weeks (17th November to 2nd December) temperatures from minus 1 to plus 6 °C were measured **(Figure 2)**. During this period the animals had an average weight of 85 to 100 kg.

The feeding behaviour of the different genotypes is not influenced by the outdoor temperature **(Figure 3)**.

Despite of these conditions the pigs did change neither the feeding frequency and the daily eating time nor the feed intake. The differences between the races concerning the feeding behaviour and the feed intake which were recorded for the whole fattening period occurred also in this period.

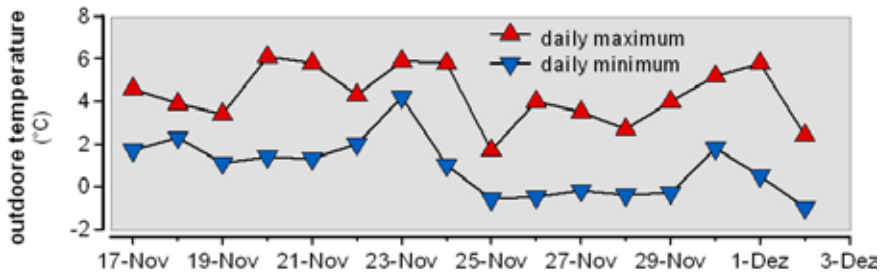
The tendentially lower temperatures in the second week did not cause a change in the feeding behaviour (number of visits and feeding duration). Furthermore no changes concerning the feed intake could be noticed.

Summary

The results show that pigs have genotype-specific features concerning the feeding behaviour. Significant differences were recorded for the feeding frequency and the daily eating duration. Temperatures around 0 °C did not influence the feeding behaviour.

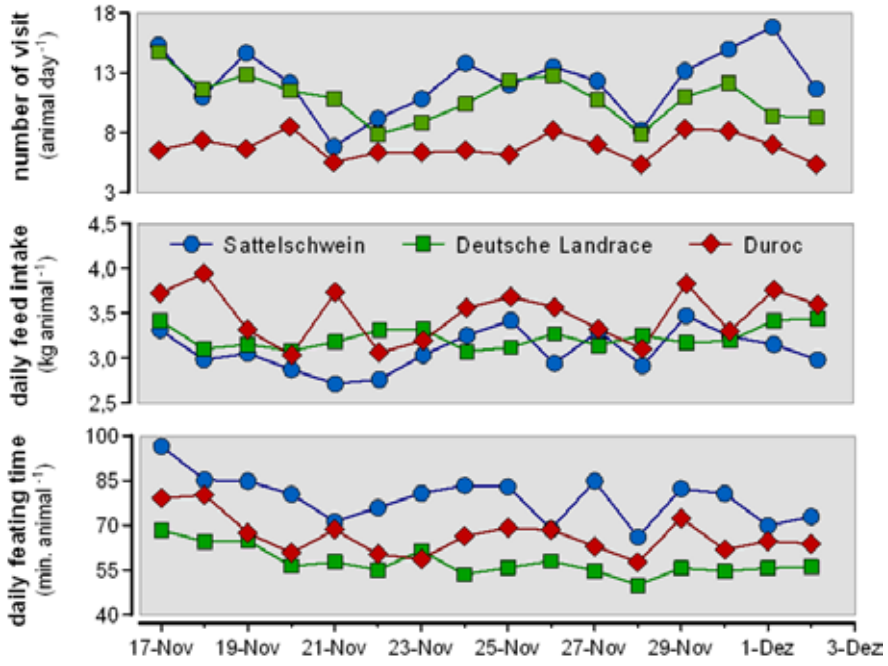
Sensor-based system are enable a continuos registration of behaviour of pigs during whole duration of housing. The sensor-based analysis of parameter of the feeding behaviour, deliver wide information about the relations between the animal and technique. This specific case showed that the genetic conditioned peculiarities concerning the feeding behaviour must be regarded in the assessment of feeding technology for pigs.

Fig. 2



Dynamic of outdoor temperature in the selected days

Fig. 3



Dynamic of daily eating time, daily feed intake and feeding frequency in the analysed period

Table 1

Parameter of Fattening efficiency, feeding behaviour and feed intake over the whole fattening period

Parameter	Mean	SD	Min	Max
Start Weight (kg)	26,93	3,58	20,50	35,00
Final Weight (kg)	111,25	11,76	94,50	20,50
Daily gain (g)	818,68	116,61	645,63	1014,56
Feed conversion (kg/kg)	3,16	0,38	2,60	3,96
Number of visit (n)	11,14	4,12	2,57	25,29
Daily feed intake (kg/d)	2,61	0,79	0,77	4,51
Daily eating time (min/d)	68,97	15,95	28,84	116,09
Feeding rate (g/min)	39,49	14,25	10,56	84,38

Literature

[1] Rus, M., Börgermann, B., Kaufmann, O.: System recording behavioural characteristics of pigs - Preference for different flooring systems. Animal Welfare, Ethology and Housing Systems , Vol III (1) 2007. S. 59-69 (Electronic Journal; http://www.animalwelfare.szie.hu)

[2] Patience, J.F.: Pig Oriented Equipment, 1998 Annual Research Report, Prairie Swine Centre Inc., Saskatoon, SK

Authors

Dipl.-Ing. agr. Mihaiela Alexandrina Rus is Ph. D student at the Department of Animal Science; **Prof. Dr. Otto Kaufmann** is Head of the Department of Animal Science and Dean of the Faculty of Agriculture and Horticulture, Humboldt- Universität zu Berlin, Philippstr.13, House 10, 10115 Berlin. e-mail: mihaiela.alexandina.rus@agrar.hu-berlin.de
email mihaiela.alexandina.rus@agrar.hu-berlin.de

Acknowledgments

Mihaiela Alexandrina Rus is financially supported by the Hans Wilhelm Schaumann Stiftung.

Table 2

Parameter of feeding behaviour and feed intake of pigs of different races

Parameter	Sattelschwein	Deutsche Landrasse	Duroc
Number of animal	6	8	6
Start weight (kg)	29,83 ± 2,60 ^{a}	24,63 ± 1,95 ^{b}	27,08 ± 4,24 ^{ab}
Final weight (kg)	101,33 ± 7,33 ^{a}	112,68 ± 10,87 ^{b}	119,25 ± 10,39 ^{ab}
Daily gain (g)	700,98 ± 70,90 ^{a}	863,35 ± 96,07 ^{b}	903,59 ± 80,82 ^{b}
Feed conversion* (kg:kg)	3,63 ± 0,24 ^{a}	2,85 ± 0,21 ^{b}	2,85 ± 0,16 ^{b}
Number of visit (n/d)	12,19 ± 2,93 ^{a}	12,33 ± 4,79 ^{a}	8,50 ± 2,74 ^{c}
Feed intake per visit (kg)	0,24 ± 0,10 ^{a}	0,26 ± 0,14 ^{a}	0,42 ± 0,27 ^{c}
Daily feed intake (kg)	2,55 ± 0,68 ^{a}	2,52 ± 0,80 ^{ab}	2,77 ± 0,86 ^{bc}
Daily eating time (min/d)	79,69 ± 13,13 ^{a}	62,27 ± 15,91 ^{b}	67,14 ± 12,82 ^{bc}
Visit duration (min)	7,65 ± 2,19 ^{a}	6,19 ± 2,37 ^{b}	9,32 ± 3,36 ^{c}
Feeding rate (g/min)	32,57 ± 9,08 ^{a}	42,60 ± 15,60 ^{b}	42,25 ± 14,32 ^{bc}

* *Feed conversion over the period from beginning of fattening until 100 kg live weight*

$^{a-c}$ *Means within a row with different subscript letters are different p<0,05; Wilcoxon Test*