Richter, Thomas

Housing of farrowing sows in loose pens – the development of Nürtinger e-motion-pen

Farrowing and nursing sows are commonly restrained in farrowing crates. Detracting from the advantages of this restraint method are considerable disadvantages in the form of ethopathic and technopathic behaviour, higher MMA susceptibility as well as increased labour and associated costs. The Nürtinger e-motion farrowing pen was developed during 14 breeding cycles with 11 to 15 sows, starting off from the Swiss-developed Schmid and FAT-2 pens and the Nürtinger System's Raidwanger farrowing pen. The resultant design offers benefits for both livestock and personnel with the sow area featuring a separate lying area with rubber mat and a perforated grid area and with an additional creep area for the piglets. The Nürtinger e-motion pen with Kraiburg rubber mat fulfils the requirements of a modern farrowing pen. In terms of labour efficiency the concept is superior not only to other types of loose farrowing pens but also to the farrowing crate

Keywords
Sows, farrowing pen, loose pen

Abstract
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The standard system for managing farrowing and nursing sows is the farrowing pen with crate. This has the least space requirement of all farrowing pen types, offers a good overview of sow and piglets and simplifies sow handling. Additionally it is generally accepted that the farrowing crate offers labour cost advantages and that less piglets are crushed with the system. Against these arguments are substantial disadvantages for the sow. Morphologically, there is mainly the occurrence of large numbers of technopathies and the sows experience inactivity-caused atrophy of the musculature. Ethologically, two function cycles are especially vulnerable. One is nest-building behaviour. The prevention of this being expressed often perverts to stereotype behaviour such as bar biting or persistent chewing motions with empty mouth. Secondly, the prevention of excretion behaviour plays an important role. Sows attempt to keep their faeces and nest-place separate. If not able to do so, excretion retention can occur. The retained faeces then become more solid within the rectal ampulla. When finally excreted the dung can cause damage to the anus mucosa, thus offering an entry point into the blood stream for bacteria (mostly *E. coli*); this results in MMA development. These disadvantages have brought the farrowing crate into animal welfare discussions. For many years now new loose (free-movement) farrowing pens have been developed as an alternative. However, even the fact that new ideas in this respect repeatedly come onto the market confirms that none of the suggestions up until now has been able to really establish itself [1]. In the pig experimental unit of Nürtingen-Geislingen University for Economy and Environment investigations were carried out with various loose farrowing pens. After every farrowing in the pens the experience gathered up until that point was critically evaluated and pen design adjusted accordingly. Limited finances for the work meant that the different versions could not be repeatedly trialled often enough and/or tested with a large enough number of sows to allow an acceptable statistical evaluation. Nevertheless, the experiences presented here offer important starting points for further development of the management techniques in farrowing pens.

Loose pens: current knowledge

So far, loose farrowing pens have followed two development directions. One starts from the farrowing crate and attempts to retain its actual or assumed advantages. In several of these pen variants the sow can – in the period nearing farrowing – be restrained by systems of swinging gates or grids. Typical repre-

Table 1

Comparison of the reproductive capacity between farrowing crates and loose pens [5]

	Bewegungsbuchten/ ***Loose pens***	**Kastenstände/** ***Farrowing crates***
Betriebe/ *Farms*	173	482
Würfe/ *Farrows*	18 824	44 837
Ferkel geboren/ *Piglets born*	11.0	11.0
Ferkel abgesetzt/ *Piglets weaned*	9.6	9.6
Ferkel erdrückt [%]/ *Piglets crushed*	5.4	4.5
Ferkel gestorben [%]/ *Piglets died*	6.7	7.6

sentatives of this type are the Völkenroder farrowing pen (also described as Vario-Fit) and the Ulrich-2000 pen [2]. The other development direction is based on behavioural observation and attempts to allow sows and piglets to express behavioural traits which they would follow in nature-near environment. Typical of these types are the Schmid, FAT-1 and FAT-2 pens [3]. Optionally, pens in the first category can be managed without straw litter and therefore with greater or lesser areas of slatted/perforated flooring while the FAT pens are mostly solid-floored and littered.

According to Lücker [4], who compared three pen types over a four year period, the Vario-Fit pen cannot be recommended. Compared with the Ulrich-2000 pen the Vario-Fit led to high trampling and crushing losses. The results show, concluded the author, that a restriction of sow freedom of movement during the suckling phase appears to be practical and justifiable for the reduction of piglet losses. Arguing against this is information from Switzerland indicating that, while more piglets are crushed in loose pens, the number of piglets weaned was just the same as in farrowing crate pens (**table 1**) [5]. Thus the farrowing crate system offers no better protection for the piglets.

Own investigations

At the Nürtingen-Geislingen University for Economy and Environment's Tachenhausen research and training farm a total of 14 farrowing cycles were involved in a research programme. Taking part in each cycle were 11–15 Schaumann hybrid sows from a multi-unit sow management system (insemination in one specialised unit, gestation period in another and farrowing and suckling at Tachenhausen). One week before farrowing the sows were installed in farrowing pens. Suckling period was approx. four weeks. All the pens were littered. The observation of the animals was via video cameras and by staff during routine work (round-the-clock monitoring of farrowing). Recorded were sow lying positions, excretion behaviour, progress of farrowing and the mother-piglet relationship.

Pen interiors were rebuilt following every farrowing cycle through to, and including, cycle 9. In cycles 10–14 variants of the rubber mat were tested. The cycles 13 and 14 served additionally for the measuring of straw input and the observation of straw utilisation by the animals. Hereby it was established that, for the expression of species-typical nest-building behaviour, a much smaller amount of straw is necessary than that required for absorption and binding of urine and manure. Daily spreading of 500 g long straw on the rubber mat around the time of farrowing proved sufficient, along with ad lib chopped straw from day 3 post partum offered in a straw rack. Straw utilisation from the racks was astonishingly low during the trials, averaging less than 100 g per day. Reducing the offered straw down to the amount required to meet behavioural requirements has a practical aspect as well because this increases labour productivity and therefore acceptance by farmers.

The experimental pig unit had 16 farrowing pens of which at least 2 were respectively Schmid, Fat-2, Ellipsoid and Raidwanger farrowing pens. The other pens were unnamed types. Even after cycle 3 the Ellipsoid pens were dismantled as unacceptable on labour grounds and as potentially hazardous. Two pens with conventional farrowing crates served as control. All pens were littered. After every cycle the pen interiors were rebuilt according to the latest experience. During the development of the Nürtinger e-motion pen all partitions were removed from the sow area. Dividing of the function area with a partition proved in every case to restrict observation and be associated with additional danger for the piglets. Partition also meant that the pen in question had to be entered for any precise control of the animals therein. In addition, the pen partition did not achieve the desired separation of sow lying and dunging area. Consequently, straw utilisation was very high at a minimum 2 kg/d, as was microbial ammonia production. Litter was completely changed twice daily but despite this substantial input of labour and material, interior climate was still not satisfactory.

Development of the Nürtinger e-motion pen

Where there was free choice of different lying areas for loose-housed sows in the pre-farrowing pens it was often observed that the dominant females defended a position on the rubber mats. This led to the gradual equipping of all pens with rubber mats in the cycles 5-9 and at the same time removal of the sow area partitions. During the cycles 10–14 various rubber mats were tested; proving best was a mat specially developed for the trial by the company Kraiburg-Elastik (**figure 1**).

In the Nürtinger e-motion pen the lying area with rubber mat, with a 2% fall towards the perforated area, is positioned along the long wall side. The sow and piglet areas are separated by a grating with a 20 cm gap between grating bottom and floor.

The piglet area in the Nürtinger e-motion pen, with heatable piglet bed area, is positioned in vertical line with the sow lying

Fig. 1

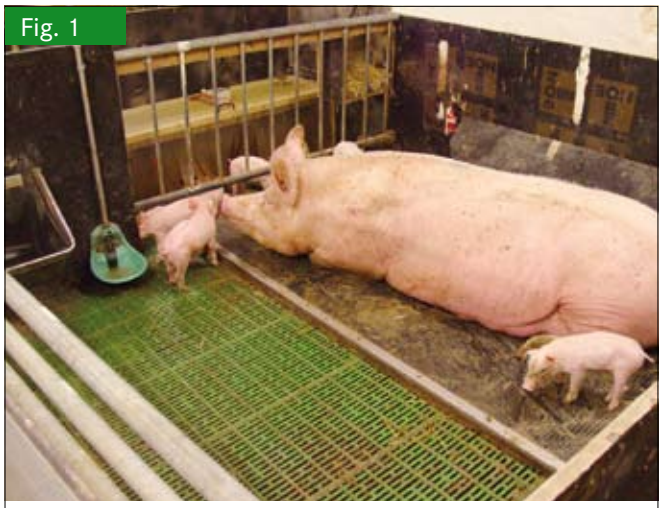

Fig. 1: Nürtinger e-motion-pen with Kraiburg rubber mat

area which enables eye contact between sow and litter members (**figure 2**).

The long side adjacent to the passage has a plastic perforated floor and this is the feeding, dunging and urinating area. It would be particularly recommendable for the further improvement of the interior climate to install a dung scraping system under the perforated flooring area. Drinking bowl and trough in the sow and piglet area are in each case situated over the perforated flooring area. The straw rack is positioned above the rubber mat. Through this positioning the cleaning and filling of the straw rack, as well as cleaning of all troughs and water bowls, is possible from the passage without having to enter the pen. Where required, automatic feed delivery as well as a straw delivery system could be easily fitted. The rear long-wall and the walls between the pens cannot be seen through. The wall separating pen and passage is also closed along the bottom but comprises railings in the upper portion. This wall includes the hinged gate to the pen. On the rear and side walls in the sow area sloping boards run from wall surface to floor at an angle of 45° with the board bottom fitted 25 cm above the floor. Buffer railings would also be possible in this position. The piglet escape opening under the creep separation grid can be closed with a moveable board so that litter members can be easily caught without handlers having to risk contact with the sow. Experiences with the Nürtinger e-motion pen in comparison with the other sow management systems are summarised in **table 2**.

Financial aspects

A component of the investigation was also a student project on the Nürtinger e-motion pen (**table 3**). The results of this indicate that a piglet production unit in a fictive facility with 300 sows using Nürtinger e-motion farrowing pens would need only 14 % more floor area than where farrowing crates are used. Farrowing crates are expensive, so the facility could be cheaper if crates are no longer required. Additionally, the costly perforated flooring with underlying manure area is markedly smaller with the Nürtinger solution. The routine work, from daily cleaning of trough to cleaning out of the whole pen area and through to castration of piglets, can be rapidly carried out because no farrowing crate is in the way. In other words, no serious financial disadvantage can be seen.

Conclusions

The development of the Nürtinger e-motion pen with Kraiburg rubber mat represents the conclusion of the research work described here. One can summarise that the system simultane-

Table 2

Experiences with 6 farrowing pens from the investigations done in Nürtingen
ranking: –– very negative, – negative, ± neutral, + good, ++ very good

Bucht/ Pen	**Übersichtlichkeit/** ***Facility of inspection***	**Stallklima/** ***Housing climate***	**Erdrückungsschutz für Ferkel/** ***Crushing protection for piglets***	**Verletzungsschutz für Sauen/** ***Injury protection for sows***	**Ethologie/** ***Ethology***	**Arbeitswirtschaft/** ***Work demand***	**Platzbedarf/** ***Space requirement***
Kastenstand/ *Farrowing crate*	+	+	±	–	––	±	++
Ellipsen/ *Ellipses*	+	–	–	––	––	––	+
Raidwanger Bucht/ *Raidwanger pen*	±	––	±	++	±	––	±
Schmid Bucht/ *Schmid pen*	––	––	–	++	++	––	––
FAT-2-Bucht/ *FAT-2-pen*	––	––	–	++	++	––	––
e-motion-Bucht/ *e-motion-pen*	++	++	±	++	++	++	––

Fig. 2

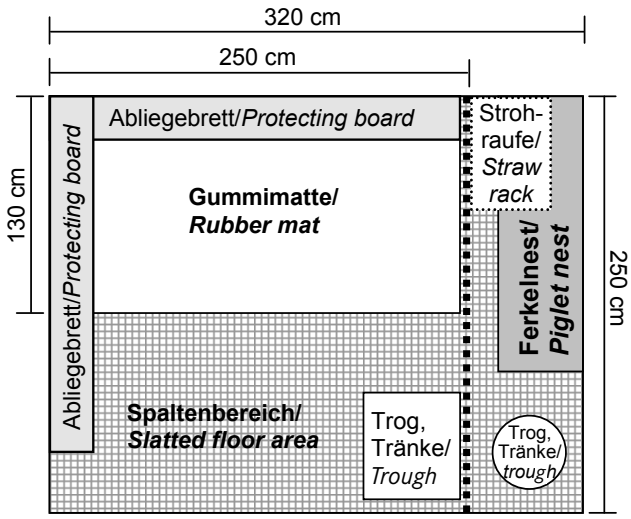

Fig. 2: Floor plan of the Nürtinger e-motion-pen

ously fulfils animal welfare requirements and those of a modern farm business: the advantages of the pen exceed its disadvantages. Particularly in comparison with other free-movement farrowing pens, great advantages for both personnel and animals are produced by the combination of rubber mat and part-perforated flooring area and the straw rack. Piglet losses were much the same as those in farrowing crate systems. However, the limited trial resources meant that not enough replicates were possible in order to achieve a statistically acceptable result. On the basis of labour requirements and the associated costs the Nürtinger pen was superior to all the others it was compared with, including the ones with farrowing crate.

Table 3

Space requirement of different stable areas in the case of a fictive holding with 300 sows

Stallbereich/ ***Stable area***	**Kastenstand im Abferkelbereich/** ***Farrowing crate in farrowing area***	**e-motion-Bucht im Abferkelbereich/** ***e-motion-pen in farrowing area***
Deck-Wartestall (kombiniert)/ *Mating-waiting stable (integrated)*	1 296 m²	1 296 m²
Abferkelstall/ *Farrowing stable*	720 m²	1 066 m²
Sonstiges/ *Other matters*	389 m²	389 m²
Gesamt/ ***Total***	**2 405 m²**	**2 751 m²**

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Authors

Prof. Dr. Thomas Richter is specialist veterinary surgeon for animal behavioural science and welfare within the Agricultural Economics Faculty of Nürtingen-Geislingen University for Economy and Environment (HfWU), Neckarsteige 6-10, 72622 Nürtingen, e-mail: thomas.richter@hfwu.de

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