

Star+: Animal and environmentally friendly housing of pigs; Control of lying and excretion behaviour

André Aarnink, Herman Vermeer, Mirjana Busancic, Nico Verdoes
Wageningen UR Livestock Research

The Star+ stable has become into use, approximately two and a half years back at the Pig Innovation Centre in Sterksel. This article discusses the lying and excretion behaviour of the pigs in the Star+ stable, which was followed for 6 rounds. The research shows that pigs are mainly lying inside on the solid floor and excreting outside on the slatted floor. During the first rounds, the solid floor became still pretty much soiled. This can be solved by placing the drinking cups outside, to choose composite slats with beams of 8 cm in width instead of triangular slats, and by letting the solid floor grow with the animals.

The Star+ stable is a stable with 12 pens, each for 18 finishers. The pigs have approximately 0.9 m²/pig inside and about 0.3 m²/pig outside. The outside area has a roof and is protected by a windbreak screen. The floor inside consists of approximately 80% solid floor and 20% metal triangular slats. The floor outside consists for 25% out of metal triangular slats and for 75% out of concrete slats. Figure 1 shows a schematic drawing of the pens in the Star+ stable.

The purpose of the research

The purpose of the research into the lying and excretion behaviour was controlling the behaviour of the pigs, in such a way that they use the different functional areas in the pen for which they are intended. In particular, the excretion behaviour of the pigs is essential in the Star+ stable as it has much solid floor. This gives a rather large risk of fouling of the pen. During six rounds the lying and excretion behaviour of the pigs has been investigated. During the first two rounds the impact of the location of the water troughs on the lying and excretion behaviour has been assessed (two troughs inside, two troughs outside or one inside and one outside). During the fifth and sixth round, the effect of letting the solid floor grow with the animals and of the type of slats on the lying and excretion behaviour has been investigated.

Lying and excretion behaviour during the first rounds

The investigation in the first two rounds shows that most of the time the pigs lie inside (94%; see Figure 2). The majority of the faeces (67%) and approximately half of the urine is produced outside. Figure 3 shows that the animals, when they are lying, lie mostly on the solid floor (87%) and defecate on the slat floor (69%). For urination this is about fifty-fifty. The comparison between the various locations of the water troughs shows that, when both troughs are placed outside, the animals excrete (defecation and urination) about 20% less on the solid floor than when one trough is placed inside and one is placed outside.

During the first four rounds (two autumn-winter rounds, one spring round and 1 summer round) an average of 7% of the surface of the solid floor was soiled with faeces and urine. In the spring round the contamination was the least (4%), in the autumn-winter rounds it was an average of 7%, and in the summer round it was an average of 10%. The heavy pigs had the highest contamination in the summer, with a soiling of the solid floor of 20% and the least fouling in the autumn-winter (2% contamination). The light pigs had the most fouling in the autumn-winter (10%) and the least fouling in the spring round (4%).

The use of the space outside

The use of the space outside during the second round, the spring season (February-May) has been analysed. This analysis shows that the pigs are outside about 12.5% of the time. In this round 73% of the time the pigs were lying inside. This means that, when the pigs are not lying inside, they spend almost half of the time outside.

Effect of type of slats and size of solid floor

The first four rounds in the Star+ stable showed that there is still too much fouling of the solid floor. This gives extra work for cleaning the pens, decreased hygiene and higher ammonia emissions. Therefore an additional focus was placed in round 5 and 6 on reducing the contamination. Two hypotheses have been tested in order to reduce the contamination of the pens:

1. The fouling can be reduced by replacing the metal triangular slats in the pen with slats that are better walkable for the animals. It seems that metal triangular slats are less walkable than for example concrete slats. When animals have enough space excrete on a different, more peaceful place, they'll do that, for example on the large solid floor.
2. At the beginning of the round the pigs have too much solid floor available, much more than they need to lie down. Because the pigs can basically use all the space, beside the lying area, to excrete, the large solid floor has a risk of contamination. By letting the solid floor grow with the size of the pigs, this contamination can be prevented.

The following types of slats are tested:

- 1) metal triangular slats with 14 mm bar and 14 mm gap (DK)
- 2) composite slats with 40 mm bar and 20 mm gap (C4)
- 3) composite slats with 80 mm bar and 20 mm gap (C8)

Each type of slat was placed in four pens. Only the slat floor inside was carried out with one of these types of slats. Detailed pictures of the different types of slats are given in Figure 4. This also includes a detail picture of a concrete slat. The concrete slat was placed outside. The size of the solid floor of the "grow pens" is shown in Table 1. The size of the lying area was made so that the pigs had just enough space to lie on the solid floor all together.

In Figure 5, the effects of the different pen and slat types on the excretion pattern of the pigs are given. These show that in "grow pens" the pigs excrete less on the solid floor (27% vs. 40% of the total number of times of urination and defecation) and more on the slatted floor inside.

Furthermore, this figure shows that with the use of triangular slats, the pigs excrete more often on the solid floor than when using composite slats. This difference, however, was only seen in the "normal pens" and not in the "grow pens". In the "grow pens" there is virtually no difference in the excretion on the solid floor between the different types of slats. However, in the "normal pens", where the animals have a large solid floor from the beginning, the contamination of the solid floor is highest with the metal triangular slats. With the composite slats with 40mm bar the contamination level is between the metal triangular slats and the composite slats with 80mm bar. The fouling of the solid floor with the composite slats with 80mm bar in the "normal pens" is equal to that in the "grow pens". The fact of more excretion on the solid floor in pens with the metal triangular slats could be because these slats are worse walkable (see below), so the pigs would rather stand on a solid floor for excreting. Another reason could be that the pigs, especially at higher temperatures, find this slat more comfortable to lie on than to lie on the solid floor and they excrete more on the solid floor as a result thereof. This cause, however, seems less plausible, since this effect than also would occur in the "grow pens". In the "grow pens" the pigs have no space on the solid floor left to use as an excretion space, thus apparently they accept the lesser walkability of the slatted floor to excrete. The fact that in the pens with 40mm composite slat more soiling occurred in the "normal pens" than in the "grow pens" could be an indication that the pigs find this slat also less attractive to excrete on.

Walkability of slatted floors

The walkability of the different slats was tested on a test track. On this track the pigs of 3 pens (3x18) where each tested four times. The pigs walked zigzag on two types of floors and got a reward at the end of the track. Prior to the first test, the pigs were trained on the test track. Per slat type, the following observations were made: duration of the walks, number of slips and number of steps. In this test, also the concrete slat (80mm bar and 18mm gap) was tested.

The duration of the walks on the concrete slat and metal triangular slat was significantly longer than the walks on the two composite slats (Figure 6). In Round 1 there are less clear differences because the pigs had to walk twice on a dry slat and twice on a dirty slat, while in round 2 the slats were dirty on all walks. The number of slips showed the clearest pattern: The metal triangular slats clearly had more slips than both the composite slat, with C8 as the best slat. The number of slips on the concrete slat was in between the composite and the triangular slats (Figure 6). The number of steps need on the broad composite slats (C8) was significantly lower than on the other slats. That means that the pigs feel more secure on this slat to take bigger steps (Figure 7).

From the walk test can be concluded that composite slats, especially those with the wider bar (C8), are more walkable than the concrete and triangular slats. However, within this research cannot be concluded whether this is caused by the material or by the profile the composite slats have. Concrete slats with a profile like the composite slats have would perhaps also test well.

Conclusion of the research

Based on this research can be concluded that the large solid floor, as used in the Star+ system, stays cleaner by:

- placing the water troughs outside
- letting the solid floor grow with the weight of the animals
- ensuring there are good walkable slats used such as composite slats with a 80mm bar

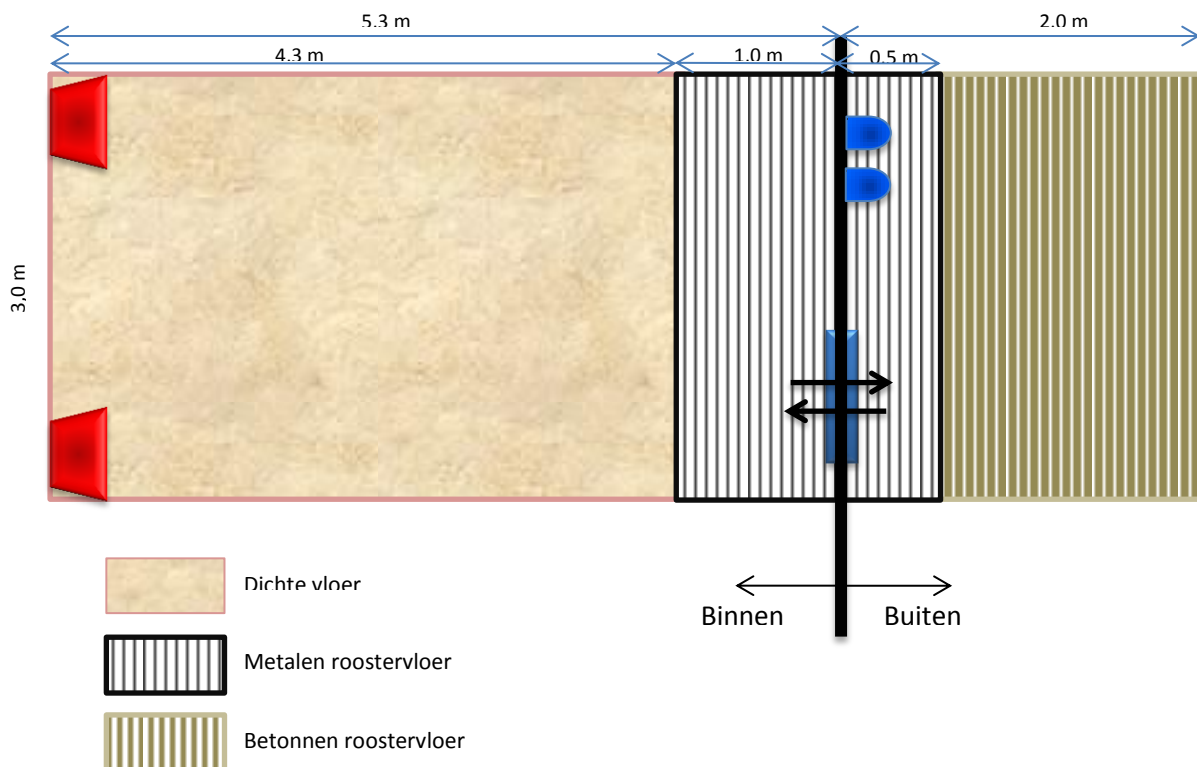


Figure 1: Schematic drawing of the pens in the Star+ stable. Red and blue components in the pen: respectively dry feed troughs and water troughs; blue component with arrows: passage to the outside.

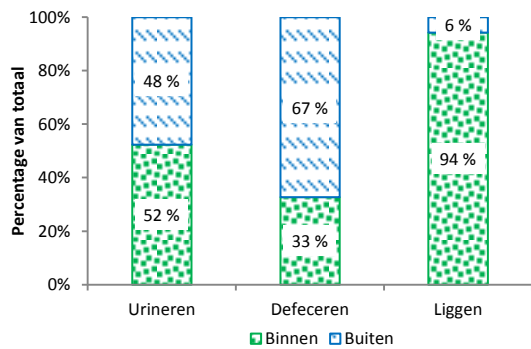


Figure 2: Percentage of urination, defecation and lying in the Star+ stable, inside and outside.

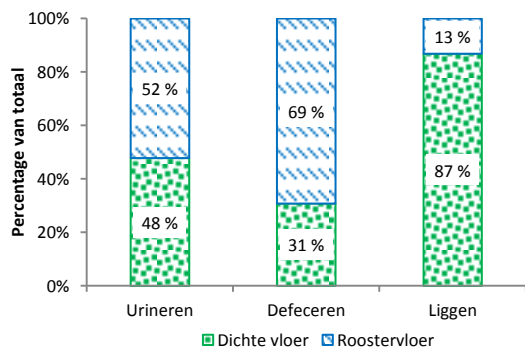


Figure 3: Percentage of urination, defecation and lying on the solid floor and the stalled floor of the Star+ stable.

Table 1: Size of the solid floor in the "grow pens".

Week after start	Weight (kg)	Depth solid floor (m)	Solid floor area (m ² / pig)	Total surface (m ² / pig)
0-4	- 40	2.3	0.38	0.86
4-8	40-70	3.3	0.55	1.03
8 - Final	70 -	4.3	0.72	1.20

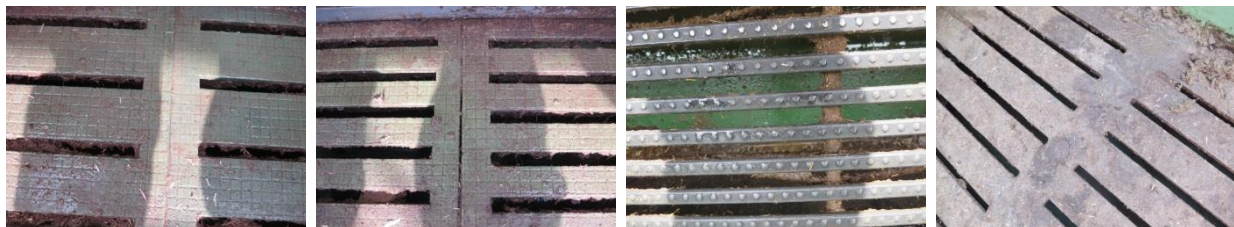


Figure 4: The slats in the research, from left to right: composite bar 80mm, composite bar 40mm, triangular slat, concrete slat.

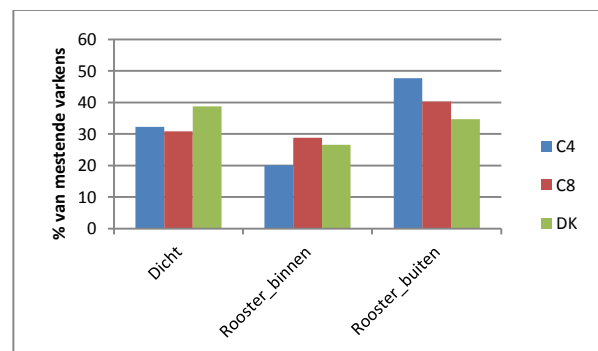
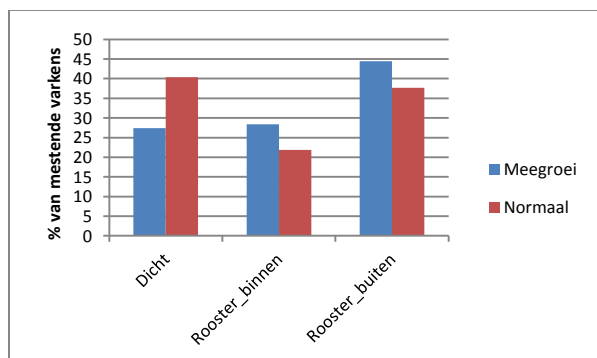


Figure 5: Pattern of excretion by the pigs in Star+. Figure left: effect of type of pen on manure pattern (% of pigs that manure (total urinate + defecate) on the solid floor, slatted floor inside and slatted outside). Figure right: effect of type of slats on manure pattern (C4 = composite slat 40mm bar, C8 = composite slat 80mm bar, DK = triangular slat).

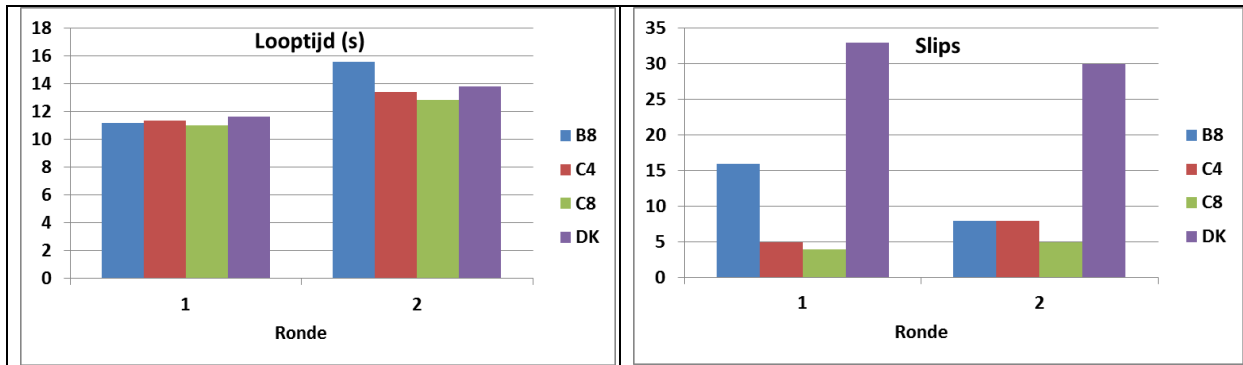


Figure 6: Average duration of walks in seconds per type of slat (left) and average number of slips per slat type (right).

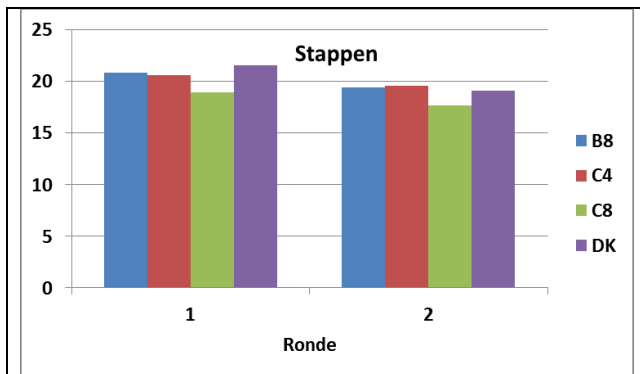


Figure 7: Average number of steps (back legs) per slat type.



Picture 1: Within the Star+ stable with a passage to the outside.



Picture 2: Water troughs outside