Integrated production of tree biomass and piglets - Effect of paddock design on sow excretory behaviour

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**Implications**

In order to reduce nutrient losses in systems with an integrated production of trees and piglets it is important that the lactating sows are motivated to urinate and defecate adjacent to the trees. In the present study, adding poplar trees in one end of individual pasture-based paddocks did not motivate the sows to choose the area with trees for elimination, which was independent of paddock design. The location of feed and hut influenced the sows’ excretory behaviour and the effect differed between the different combination of feed and hut location. Future work should be focused on overall paddock design to optimize nutrient uptake and to ensure an outdoor system that is sustainable from both a welfare- and environmentally point of view.

**Background and objectives**

Free-range pasture systems for organic pigs comply well with the organic principles and the organic consumers’ expectations to organic livestock production. However, the systems as practiced in the Northern countries are associated with high risks of nutrient losses. This is caused by high inputs of concentrated feed combined with poor vegetation cover due to the pigs’ rooting behaviour (Eriksen et al. 2006). There is a need for further development of free-range systems to reduce the environmental footprints of organic pork production.

An integrated production of tree-biomass and pork in pasture-based systems is expected to reduce nutrient losses compared to pasture systems without trees. Well-established trees like e.g. poplar are more robust to the pigs rooting behaviour and have deep root systems with nutrient uptakes across a long growing season compared to grass (Jørgensen et al. 2005). This will reduce the risk of nutrient leaching in pasture systems.

It is crucial that pigs are motivated to deposit the majority of urine and faeces close to the trees. The sustainability of an integrated system therefore depends on the ability to control excretory behaviour of pigs. Previous studies have shown that feed and hut location do affect choice of elimination area (Eriksen & Kristensen 2001). In addition, it seems that pigs prefer to excrete near to trees or near to high vegetation areas (Horsted et al. 2012). The objective of the present study was to investigate the effect of spatial arrangements of trees, hut and feed on lactating sows’ excretory behaviour in a pasture-based system with four rows of poplar trees.

**Key results and discussion**

Based on previous studies by Horsted et al. (2012), it was assumed that the pigs would prefer to eliminate in the tree zones. As a consequence, this preliminary and first part of the analyses focused on the distribution between the grass zones (zone 1-3) and the tree zones (zone 4-5). Across paddock design, the sows in average were observed to deposit 35% and 52% of urine and faeces, respectively, in the zones with trees, which constituted 34% of the total paddock area.

Regarding effect of paddock design, for the distribution of faeces a three-way interaction was found between zone, hut and feed location (p<0.05). If the hut was located in zone 3 (closest to the trees) and the feed in zone 1 (farthest away from the trees), the sows defecated mainly in the tree zones. Whereas if both the hut and the feed was located in zone 3, only 34% of the defecation was observed in the tree zone. Taking into account the difference in zone size, it means the distribution per unit area were similar in the two zones. The same was observed if the hut was located in zone 2 and feed in zone 3. For the urination, the highest proportion of urination was for all treatments observed in the grass zones (p<0.05). The lowest proportion of urination (26%) in the tree zone was observed if the hut was located in zone 1 and feed in zone 3, whereas the highest proportion (43%) was observed if both hut and feed was located in zone 3, but no significant effect of treatment (P=0.11) was found.

In accordance with the result reported by Stolba & Wood-Gush (1989), Salomon et al. (2007) and Watson et al. (2003), no urination or defecation was observed in the 1m zone around the hut, feed and water troughs. In addition, no elimination was observed in the wallow in accordance with the results reported by Sambraus (1981).

Our results could not fully confirm the results reported by Horsted et al. (2012), that the pigs prefer to eliminate in the trees. However, the elimination behaviour seems to be affected by the location of the feed and hut, which has also been reported by Eriksen & Kristensen (2001) and Salomon et al. (2007). Preliminary results from the present study indicate that sows can be motivated to eliminate in the tree area if the hut is located nearby the trees, and if the feed trough is located at the opposite end than the trees. Locating both resources nearby the trees should be avoided. Next step is to analyse if the distribution of urine and faeces in the paddocks is related to the resting and foraging behaviour. This includes looking more closely on the distribution in the individual paddock zones (1-5).

**How work was carried out?**

The experiment was carried out during spring and autumn 2016 on an organic pig farm in Denmark. It included twenty-four Landrace X Yorkshire sows housed in individual farrowing paddocks (36x13m). Each paddock was divided into five zones. Zone 1-3 consisted of grass clover and zone 4-5 each included two rows of four poplar trees. In all paddocks, a wallow was located in zone 2. The sows were randomly allocated to the six treatments: Feed trough located in zone 1 (farthest away from the poplar trees) or in zone 3 (closest to the poplar trees), and the hut located in zone 1, 2 or 3. Each sow was observed from sunrise to sunset, one day in the third- and the sixth week of the lactation. The sows’ location and activity (e.g. lying, standing, grazing and rooting) was observed by scan sampling with 10 min. interval. Urination and defecation was observed by all occurrences observations. The effect of paddock design on the proportions of faeces and urine (e.g. number of defecations in the tree zone as the proportion of total defecations in the whole paddock per sow) were investigated by a binomial model using the glm procedure in R. The model included the following: zone, hut and feed location.

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