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Outdoor production of slaughterpigs requires an optimized management to mitigate N pollution

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In Danish outdoor pig production the sows are usually kept on grassland, while their progeny are transferred at weaning to indoor housing with access to an outdoor concrete pen.

It may seem paradoxical that a large part of meat consumed from outdoor systems comes from pigs that during the majority of their life have been prevented from natural behaviour such as rooting, digging and grazing. The explanation is the drawbacks of rearing growers outdoors including huge space demand, high work expenditure, high feed consumption and high environmental costs due to nutrient losses to aquifers and the atmosphere caused by high nutrient load and difficulty maintaining grass cover. However, it may be questioned if pigs reared indoors comply with consumers' expectation for animal welfare in outdoor pig production systems. Therefore, systems need to be developed for growing pigs on grassland.

Perfomance of outdoor systems

A Danish study has investigated effects of different strategies for rearing growing pigs outdoors on performance and carcass characteristics (Strudsholm and Hermansen 2005, Oksbjerg et al. 2005). Compared with pigs fed *ad libitum* indoors, outdoor reared pigs fed *ad libitum* did not differ in daily gain, but had a higher feed consumption. Restricted feeding outdoor reduced daily gain but improved feed conversion to a level similar to indoor feeding. Pigs reared outdoor until 80 kg of live weight or in the entire rearing period had improved carcass characteristics with leaner meat and less back fat, and in addition the restrictively fed outdoor pigs had a higher proportion of polyunsaturated fatty acids in muscles. It was concluded, that outdoor rearing may be a competitive option even in a temperate climate and all year round.

Environmental aspects of outdoor systems

An associated study has focussed on the environmental impact of these strategies. The specific objectives were to evaluate nutrient use efficiency (NUE) and nutrient load and distribution in outdoor pens with growing pigs that:

- spend part of or their entire life on pasture
- are fed either restrictively or *ad libitum*
- are weaned at different times of the year.

The experiment was established at the organic experimental farm, Rugballegaard. The idea behind the design was to minimize the space

demand within the current regulations on nutrient load and at the same time utilize current knowledge on how to attempt homogenous excretion behaviour by pigs through paddock design and management.

Piglets born on grassland were distributed at weaning on five treatments **(Table 1)** that were replicated five times during a year. Each experimental unit consisted of ten pigs. The grassland was a second year grass-clover pasture and each treatment in each replicate was introduced to a new piece of land.

The stocking rate was calculated to cause a nitrogen deposition of 280 kg N per ha based on the national definition of a livestock unit and the national guidelines allowing pigs on pasture every second year. The huts, feeding and water troughs were moved every fourth week, to minimize hot spots caused by animal excretory behaviour or feed waste.

Large potential for nutrient loss

The actual nutrient surplus of the paddocks **(Table 2)** considerably exceeded the intended 280 kg N per ha. This was caused by a combination of 20 pct higher N content of the organic feed and higher feed consumption than for conventional pigs that formed the basis for the definition of animal units and nutrient load.

The nitrogen use efficiency in the paddocks (feed N input relative to animal N output) decreased the longer pigs were kept on the pasture as a results of the well-known increased feed consumption per kg gain. Thus, N in piglets kept outside until 40 kg accounted for 38 pct of feed N input whereas N in piglets on pasture until slaughtering accounted for only 30 pct of feed N input.

Increase in soil N

Soil samples were collected each time pigs were transferred from the field to housing or slaughterhouse. Grid points were established for every 5x5 m in the 10 m wide paddocks and similarly points were established outside the paddocks for every 5 m as a reference. In each point soil samples were collected to 40 cm by pooling 8 soil cores.

A total of 948 soil samples was analysed for content of mineral N, exchangeable K and extractable P to determine the level and the distribution of nutrients within the paddocks. The content of soil inorganic nitrogen was considerably raised compared to the soil outside the paddocks **(Figure 1)** however only corresponding to 18-32 pct of the N surplus.

The N surplus in the paddocks consists of N excreted by the pigs, taken up by plants, loss (nitrate leaching, ammonia volatilisation and denitrification) or accumulation in soil organic matter. Thus the huge surplus indicates a very huge loss potential in these paddocks as the majority of excreted N is inorganic, plant cover was negligible (see below) and similarly the expected accumulation in soil organic matter was low. This is the case even if the inorganic N found in the field at soil sampling is utilised efficiently, which may be difficult during autumn and winter.

A prerequisite for efficient nutrient utilisation is a homogeneous distribution of the manure avoiding hot spots. Regarding this aspect the regular moving of huts, feeding and water troughs seemed successful as N, although with some variation, was distributed throughout the paddocks **(Figure 1)**.

Difficult to maintain grass cover

Grass cover was estimated by determining spectral reflectance in the sow paddocks at each point of soil sampling. Generally, it was difficult to maintain a grass cover in the paddocks especially during autumn and winter. Grass cover was not related to the experimental treatments but only to time of year **(Figure 2)**. During spring and in summer, some grass cover was present in isolated parts of the paddocks whereas during autumn and winter the pigs kept grass cover below 10 pct at all times. No relationship existed between grass cover and soil inorganic N although none of the few spots in the paddock with grass cover above 50 pct had very high inorganic N contents.

Seasonal production attractive

Growing pigs on pasture has benefits in terms of reduced housing costs, a leaner carcass, and allowing the pigs to perform a natural behaviour, not to mention that it is a prerequisite in organic production that pigs should be allowed summer grazing although at the moment it is allowed to keep pigs in indoor facilities with access to an outdoor area.

However keeping growing pigs on pasture may obviously be problematic from an environmental point of view as it carries a high risk of nutrient loss. Certainly, the nutrient loss potential in this experiment was huge and will inevitably have lead to actual losses because of the huge nutrient surplus. This highlights the extreme importance of lowering stock density and reducing the level of dietary N. The data also showed that uniform distribution may be obtained if huts, feeding and water troughs are moved regularly.

Considering the problems of maintaining grass cover high levels of nutrient deposition may only be acceptable if followed by a nutrient demanding catch crop or main crop, which will only be possible if growing pigs are on pasture from February to August. Thus, seasonal production seems the most environmentally acceptable way of keeping growing pigs on pasture.

References

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