

Abstract Key Note: Sustainable Feed Production in Future Pig Farming

The future of pig feed production must support healthy pigs with high productivity while minimizing environmental, climate, and biodiversity impacts. A significant portion of pork's carbon footprint originates from feed production, accounting for approximately 65% globally and around 70% under Danish conditions, as indicated by WRI and Seges, respectively. To achieve substantial reductions in pork's climate footprint, primary attention must be directed toward lowering the emissions associated with feed production.

Efforts to reduce the carbon footprint of pig feed should focus on four main areas: 1) land-efficient production, 2) low nitrous oxide emissions from feed production, 3) maximizing the use of by-products for feed, and 4) carbon sequestration in soils where feed is cultivated.

Land-efficient production is essential in reducing feed-related emissions. While land-efficient systems are not rigidly defined, limiting the land used for feed production is critical. Agricultural land is a finite resource, and the expansion of farming has substantial effects on greenhouse gas emissions and biodiversity loss. Efficient land use can be achieved by employing advanced crop varieties and sustainable farming techniques, including varieties developed through New Genetic Technology (NGT), which enhance yield without excessive nutrient loss.

Low nitrous oxide emissions in feed production may require multiple approaches, such as applying nitrification inhibitors to mineral or organic fertilizers used in feed crop fields. Research also indicates that replacing legume-based protein with grass-derived protein may inadvertently raise nitrous oxide emissions, particularly when grass is fertilized with organic fertilizers, which tend to produce higher nitrous oxide emissions. However, it should be considered that producing protein from grass can provide additional benefits, such as reducing nutrient loss from production or decreasing the need to transport plant-based proteins around the globe. Recent studies, including Danish research, underscore the need to focus nitrous oxide reduction efforts on organic fertilizers, as emission patterns can vary greatly. Further investigation is necessary to clarify how to minimize nitrous oxide emissions from crop residues, fertilization strategies, and new crop varieties.

Maximizing the use of by-products can further reduce both land use and nitrous oxide emissions. This approach includes using by-products directly as pig feed where veterinary considerations are met or converting them to proteins through biotechnological processes or insect production.

Carbon sequestration in soils used for feed production offers another strategy for reducing emissions in the pig production value chain. Sequestration can occur through soil-enriching cultivation practices, though these practices face challenges in land-efficient systems, long time horizons, and validation difficulties. However, using biochar to sequester carbon could provide a consistent and reliable solution, provided the quality of biochar is high, as it can vary significantly.

This framework offers a structured approach to sustainable feed production in pig farming, aligning feed systems with reduced climate impact goals and supporting future-ready agricultural practices.