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## Economic and environmental optimization of feed sequence plans in pig fattening unit

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**Economic and environmental optimization of feed sequence plans in pig fattening unit***F. Garcia-Launay, L. Brossard, T. Plantevin and J.Y. Dourmad**INRA, Agrocampus Ouest, UMR1348 PEGASE, Domaine de la Prise, 35590 Saint-Gilles, France; florence.garcia-launay@rennes.inra.fr*

Pig livestock farming systems face economic and environmental issues. The pig fattening unit is responsible for most of the feeding cost and nutrient excretion in pig farming. Thus, optimizing the feed sequence plans of growing-finishing pigs is a way to improve the economic and environmental outputs on a commercial farm. We developed a model, called PigOptim that optimizes the feed sequence plan of a population of growing pigs. PigOptim calculates the environmental impacts of pig production by Life Cycle Analysis (LCA). It optimizes the number of feeding phases, the average live weight at the beginning of each phase, the lysine supply (from 70% to 130% of the average requirement of the population) and the formula of each feed with a multi-objective function which integrates gross margin (GM) of the unit and its impact on Climate Change (CC). PigOptim includes response laws of growth performance issued from simulations performed with InraPorc<sup>®</sup> software for a population. For an optimization of GM only, the best results of GM and CC were obtained for a lysine supply between 90% and 100% of the average requirement of the population, whereas animal performance was maximized at 110% of the average requirement. Indeed, reducing feed costs between 110% and 90% of the average lysine requirement compensates for the reduction in growth performance. This result highlights the interest of models accounting for animal variability when investigating economic and environmental issues. The simultaneous optimization of GM and CC led to a reduction of GM and CC, but some other environmental impacts increased. These first results suggest that PigOptim gives consistent estimations of animal performance, GM and environmental impacts. To our knowledge, PigOptim is the first model optimizing feed sequence plan on criteria calculated by LCA. In the future, PigOptim will have to include various environmental impacts in the objective function and will need an improved optimization process for further integration into a decision support system.

**The effect of nutrition on environmental impacts of pig production depends on production context***A.N.T.R. Monteiro<sup>1</sup>, F. Garcia-Launay<sup>2</sup>, L. Brossard<sup>2</sup>, A. Wilfart<sup>3</sup> and J.Y. Dourmad<sup>2</sup>**<sup>1</sup>Animal Science Department, Maringá State University, PR, Brazil, <sup>2</sup>INRA AgroCampus-Ouest, UMR PEGASE, 35590 Saint-Gilles, France, <sup>3</sup>INRA AgroCampus-Ouest, UMR SAS, 35000, Rennes, France; florence.garcia-launay@rennes.inra.fr*

The objective of this study was to evaluate with life cycle assessment (LCA) the effects of different feeding strategies, including phase-feeding, precision-feeding and addition of feed-use amino acids (FU-AA), on the environmental impacts of pig production, in two contrasted geographic contexts, Brazil and France, with soybean from South (SO) or Center West (CW) Brazil. The LCA considered the process of pig fattening, including production and transport of feed ingredients and complete feeds, raising of pigs, and manure management. Impacts were calculated at farm gate and the functional unit was one kg of body weight gain over fattening. Performances of pigs were simulated for each feeding scenario (n=96) using InraPorc population model (2000 pigs per scenario) and considering between-animal variability. The LCA calculations were performed for each pig according to its own performance and excretion, and the results were subjected to variance analysis. The results indicate that for some impacts there are clear interactions between effects of feeding program, origin of soybean and location of production. For climate change, the interest of phase feeding and incorporation of FU-AA is limited and may even be counterproductive in Brazil with soybean from SO, whereas it appears to be an efficient strategy with soybean from CW, especially in Europe. Similar effects are observed for cumulative energy demand. Terrestrial ecotoxicity is lower and almost not affected by feeding strategy in Brazil, whereas in France this impact is reduced by both increasing the number of feeding phases and including more FU-AA. Conversely, eutrophication and acidification potential impacts are reduced by phase feeding and FU-AA addition in a rather similar way in all situations. In all situations, precision feeding appears the most effective feeding program for reducing life cycle impact of pig fattening.