A HERD MODELING APPROACH TO DETERMINE THE MOST ECONOMICALLY AND ENVIRONMENTALLY INTERESTING DIETARY AMINO ACID LEVEL DURING THE FATTENING PERIOD

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InraPorc is a model and software tool designed to evaluate the response of pigs to different nutritional strategies. In this study we simulated herd performance using InraPorc to evaluate different feeding strategies in terms of economic performance and environmental impact. A population of 1000 virtual pigs was generated having the same variance-covariance structure of feed intake and growth parameters as those observed in a real population of pigs. Performance of these pigs was simulated using different feeding strategies varying in digestible lysine to net energy (NE) ratio in the diet (85 to 115% of the mean requirement of the population) and number of diets used (i.e., a single phase strategy, a two phases strategy (diet change at 112 days of age) or a continuous multiphase strategy where the lysine/NE ratio was changed daily according to requirement. Diets were formulated on a least-cost basis using two scenarios of feed prices with either ingredient prices of September 2007 (P1) or March 2009 (P2). Simulations ended at a mean population body weight of 112 kg. Carcass payment was calculated according to French payment grid for lean meat content of carcass (March 2009). Average daily gain (ADG) and mean lean meat content increased while feed-to-gain ratio (F:G) and duration of growth decreased with increasing lysine content according to a curvilinear-plateau relationship. Maximum performance (ADG = 897 g/d; F:G = 2.65) was attained for a supply of 105 to 115% of the mean population requirement for lysine/NE. Increasing the lysine/NE ratio was associated with a reduction in total feed cost (due to the shorter duration of growth) for the P1 scenario independently of the number of diets used. For the P2 scenario, this reduction occurred only for the continuous multiphase strategy. In the P1 scenario, economical return (carcass payment minus feed cost) increased with increasing lysine/NE ratio and was maximal with a two phases strategy and a lysine/NE ratio corresponding to 110% of the mean population requirement. In P2 scenario, economical return increased with lysine/NE ratio for the two phases and continuous multiphase strategies and reached a maximum with a supply of 105 and 115% of the mean population requirement, respectively. When using a lysine/NE ratio greater than the mean population requirement, multiphase feeding strategies reduced nitrogen excretion by 6 to 15% compared to single phase strategy, as a result of increasing efficacy for protein deposition, shorter duration of growth and reduced total feed intake. Relation between economical return and nitrogen excretion depends of the feeding strategy. Using multiphase strategies allows optimizing economical return while reducing nitrogen excretion. Apart from the interest of modeling the herd (and to include the variation between animals), stochastic simulation modeling can be helpful in multiple criteria evaluation of feeding practices.