DEVELOPMENT OF AN INNOVATIVE PRECISION FARMING SYSTEM FOR SWINE

PROJECT LEADER

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PROJECT OBJECTIVE

To acquire the required scientific knowledge to feed pigs individually with tailored daily diets for optimal management of feed and animals and develop the numerical procedures necessary for development of a fully automated commercial precision feeder system for swine.

Adjusting the nutrient supply in order to meet the individual requirements is one way to reduce environmental impacts (25%) and feeding costs (by more than $8 per pig) during the growing-finishing period.

FINAL RESULTS

MODEL THE METABOLISM OF PHOSPHORUS (P) AND CALCIUM (CA) AND DEVELOP A SYSTEM APPROACH TO ESTIMATE EACH PIG'S INDIVIDUAL DAILY REQUIREMENTS

The model developed in this project adequately simulates the metabolic fate of P and Ca along with their interactions. The model is helpful for fine-tuning P and Ca levels depending on the economic and feeding contexts.

MODIFY CURRENT FEED FORMULATION PROGRAMS FOR SIMULTANEOUS OPTIMIZATION OF TWO PREMIXES WITH ENVIRONMENTAL CONSTRAINTS AND OPTIMAL NUTRIENT DENSITY

Reducing feed cost by 5.2% could be performed through a daily phase feeding strategy with a free energy formulation using two optimised premixes. However, nitrogen and P excretions could be increased by 7% and 11% respectively. To control this negative effect on nutrient excretion, a multi-criteria model needs to be developed.

CALIBRATE THE MODEL FOR OPTIMAL LYSINE

The model developed within the precision farming system underestimates lysine requirements of pigs from 25 to 50 kg, while it adequately estimates the needs for pigs from 70 to 100 kg. This model has to be re-evaluated using different genetics of pigs.

UPDATE THE ACTUAL MODEL FOR REAL-TIME PREDICTION OF FEED INTAKE, WEIGHT GAIN AND PREDICTING NUTRIENT REQUIREMENTS

The developed model can monitor the feed intake and weight trajectories of each individual animal of the farm in real-time with good accuracy. Based on these trajectories and using classical factorial equations, the model allows estimating dynamically each individual animal nutrient requirements and optimal dietary nutrient concentration. In an effort to develop sustainable precision farming systems for swine, the proposed model can be integrated into feeders and provided to each pig with daily tailored diets.

STUDY THE INDIVIDUAL FEED INTAKE PATTERNS FOR EARLY IDENTIFICATION OF DISEASES

The developed tool helps to predict feed intake patterns but more work needs to be done in order to improve this tool and avoid variation by taking into account pig growth and pig daily feed intake behaviour.

EVALUATE THE ECONOMIC AND ENVIRONMENTAL IMPACTS OF PRECISION FEEDING SYSTEMS

Evaluation showed that the transition from a conventional to a precision feeding system would lead to an $8 per pig reduction in feed costs. Trial results indicated that in relation to three phase feeding systems, individual precision feeding systems reduced lysine intake by 27% while nitrogen excretion by 30%, without affecting animal performance.