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**Development of a decision support system for precision feeding application in pigs and poultry**

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Precision feeding is a promising way to improve feed efficiency and thus economic and environmental sustainability of livestock production. A decision support system (DSS) was built to determine in real-time the nutritional requirements of animals and feed characteristics (i.e. composition, amount) for an application of precision feeding in pig and poultry commercial farms. This tool, dedicated to animals managed individually or in groups, is designed with a modular structure for adaptation to different feeder devices, species and production stages. The modules are built to perform specialized tasks in a cooperative way. It includes a data management module with a proper characterization of data by meta-data definition for precision feeding. It ensures standard encoding to allow data interoperability from any platform. Other modules are dedicated to data verification and correction for inclusion in a database, prediction of most probable body weight (BW) gain and feed intake (*ad libitum* or restricting feeding), and the calculation of nutritional requirements. The BW and feed intake prediction is based on dynamic data analyses. For that, specific methods have been evaluated and selected depending on the number of available data, data type (BW or feed intake), and recording frequency. The calculation of nutritional requirements is performed using nutritional models specific for a species or production stage. These two modules are currently designed for healthy animals and will be refined to extend prediction to a larger range of field situations (e.g. health problems, climatic conditions) with nutritional models in development/refinement in other workpackages of the project. The general specifications of this DSS and dynamic data analyses will be illustrated for growing pigs. This study is part of the Feed-a-Gene project and received funding from the European Union's H2020 program under grant agreement no. 633531.

**Development of a decision support tool for precision feeding of pregnant sows**

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Nutritional studies indicate that nutrient requirements for pregnancy differ largely among sows and according to the stage of pregnancy, whereas in practice the same diet is generally fed to all sows in a given herd. In this context, the availability of new technologies for high throughput phenotyping of sows and their environment, and of innovative feeders that allow the distribution of different diets, offers opportunities for a renewed and practical implementation of prediction models of nutrient requirements, in the perspective of improving feed efficiency and reducing feeding costs and environmental impacts. The objective of this study was thus to design a decision support tool that could be incorporated in automated feeding equipment. The decision support tool was developed on the basis of InraPorc® model. The optimal supply for a given sow is determined each day according to a factorial approach considering all the information available on the sow: genotype, parity, expected prolificacy, gestation stage, body condition (i.e. weight and backfat thickness), activity, and housing (i.e. type of floor and ambient temperature). The approach was tested using data from 2,500 pregnancies on 540 sows. Energy supply was calculated for each sow to achieve, at farrowing, a target body weight established based on parity, age at mating and backfat thickness (18 mm). Precision feeding (PF) with the mixing of two diets was then simulated in comparison with conventional (CF) feeding with a single diet. Compared to CF, PF reduced protein and amino acid intake, N excretion and feeding costs. At the same time, with PF, amino acid requirements were met for a higher proportion of sows, especially in younger sows, and a lower proportion of sows, especially older sows, received excessive supplies. This study is part of the Feed-a-Gene project and received funding from the European Union's H2020 program under grant agreement no. 633531. The data used for the simulations were issued from a project conducted within the AgriInnovation Program from Agriculture and Agri-food Canada.