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Development of a generator of virtual pigs based on a generic covariance pattern for modelling growth performance to account for variability among individual pigs in deterministic growth models

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Introduction

Most pig growth models are deterministic and they consider only the mean pig and not the group of pigs. Inclusion of variability among individuals in modelling approaches is required to better understand the effects of feeding strategies on mean growth, economic and environmental performance, but also the variability of these traits. The aim of this study was to obtain and to use the information of the covariance structure of model parameters, such as those used in InraPorc, and to propose a generator to create virtual pig populations.

Methods

Data for daily feed intake and live weight of 1288 gilts and barrows from 10 terminal crossbreeds reared in France and 10 batches (IFIP, Romillé, France) were collected from 70 days of age to 110 kg body weight. Each individual animal was characterized using the InraPorc model by 5 parameters (2 for daily feed intake and 3 for growth) (Vautier *et al.* 2013). The effects of crossbreed, sex, batch, and their interactions on the mean values of parameters were analysed. To investigate whether covariance structures share common tendencies, the covariance relationships among parameters were analysed according to the Flury hierarchy (1988) by a comparison of covariance matrices depending on the level of animals grouping (i.e., crossbreed, sex, batch, and their interactions).

Results and Discussion

The mean values of parameters depended on sex and batch. The covariance structure of parameters differed from one group to another, a group being defined as a combination of crossbreed, sex and batch. A generic covariance matrix of parameters was calculated as the median matrix from all 40 groups' matrices. It appeared to be a better estimator of the observed covariance than a raw covariance matrix (computed from the 1288 individuals) for 72% of the 40 group matrices. A generic covariance pattern was then proposed to represent a group of pigs by combining this generic covariance matrix, observed probability distributions of parameters, and a specific vector of parameters means. As multivariate generators based on classical distributions and independency of parameters were not able to reproduce the population, a generator of virtual pigs was developed based on this covariance pattern with specific steps to take into account dependencies between probability distributions of parameters.

This work allows considering the inclusion of stochasticity aspects in models and decision support tools, such as InraPorc[®]. This will help users to study and propose innovative and realistic feeding strategies, meeting performance and environmental goals and considering / using variability among individual pigs.

References

Flury B (1988) 'Common principal components and related multivariate models'. (Wiley, New York)
Vautier B, Quiniou N, van Milgen J, Brossard L (2013) Accounting for variability among individual pigs in deterministic growth models. *Animal* **7**, 1265-1273. doi:10.1017/S1751731113000554

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