New selection strategies for better feed use
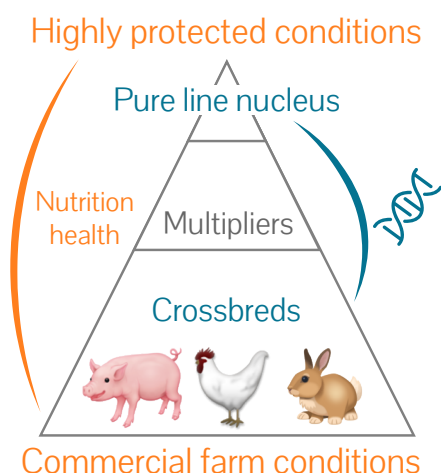
More efficient and better adapted animals

Faster population improvement

The challenge

Highly protected conditions

Pure line nucleus

Nutrition health

Multipliers

Crossbreds

Commercial farm conditions

Monogastric animals are usually selected as purebred lines using records from nucleus farms, whereas commercial farms raise crossbreds. Nucleus farms provide better sanitary and nutritional conditions than production farms so that animals can express their best performance. Also, purebreds have different gene combinations compared to crossbreds. As a result, predictions in commercial farms always deviate from the standards obtained in nucleus farms.

Directly improving feed efficiency of crossbreds through genetic selection of purebreds is a promising goal, but feed efficiency is challenging to measure in production farms due to the specific and often costly resources necessary to record it. This makes it difficult to select for crossbreds that consume less feed and have a lower environmental impact.

The Feed-a-Gene project tested approaches that could be used to improve the accuracy of selecting feed efficiency for production farms:

◗ Individual measurements of feed intake in groups of poultry and rabbits through automated devices or video cameras.

◗ Individual measurements of body samples (*e.g.* feces, blood, saliva, hair).

◗ New statistical models based on existing data to capture timeline dynamics, dynamics of groups, and trait heterogenity.

After testing more than ten types of measurement, five were found to be promising to further improve feed efficiency by genetic selection in different production environments.

Our solutions

Novel technologies & concepts

The transmission of the tested indicators from one generation to the next one was quantified with state-of-the-art genetic models, resulting in the identification of the most promising criteria to improve feed efficiency.

Individual feeding devices

In rabbits and poultry, new technologies allow the recording of individual feed intake in small groups (for rabbits) or large groups (for poultry), with the following results:

◗ Individual records of feed intake were found to be heritable.

◗ Feed intake could be used for selection for feed efficiency.

Individual feeding device for group-housed broilers

Group records

Group records can be used in pigs for two different purposes:

◗ To estimate the influence of penmates individual performance, to better select for the ability to grow in groups.

◗ To consolidate individual records when costs or management limit individual recording.

Intestinal microbiota

The quantification of the composition of intestinal microbiota in pigs and rabbits resulted in two important findings:

◗ Some components of microbiota are heritable.

◗ Some components of microbiota differ with feed efficiency.
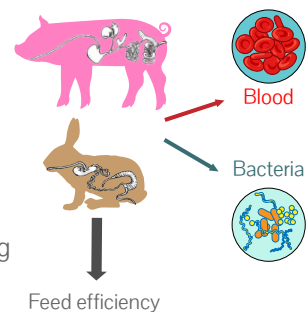
The next step is to reconcile these findings to turn the results of the analysis of microbiota into a breeding trait for feed efficiency.

Blood
Bacteria
Feed efficiency

Nutrient & energy digestibility

Using NIRS technology to quantify digestibility, it was shown that the digestibility of energy, organic matter and nitrogen of the feed could be predicted and that these digestibilities have a potential to be used for selection purposes.

Blood traits

◗ In broilers, a specific wavelength of the NIRS spectra of blood serum was found to predict digestive efficiency with high accuracy.

◗ In pigs, it was possible to identify combinations of gene expressions that predicted differences in feed efficiency between individuals.

Recommendations & benefits

◗ In each of the three livestock species targeted by Feed-a-Gene, at least one promising solution (individual feeders in rabbits and poultry, group records in pigs) was proposed, either to increase genetic gain or to reduce phenotyping costs.

◗ Digestibility, microbiota and biomarkers are promising for genetic selection and still require further investigation and validation before they can be implemented in farms.

Concept & design: AFZ