Protein and energy in pig feeds: evaluation of their value and requirements

Olmix recently organised a seminar in Hanoi, Vietnam, on the topic of swine nutrition. Over 70 guests attended the seminar where the main speaker was Dr Jean Noblet, a renowned nutritional researcher with INRA (the French National Agriculture Research Institute), former director of the INRA St Gilles research unit and the present editor-in-chief of Animal peer review journal.

Jean presented papers on two topics. The first focused on the protein and energy value of pig feeds.

With the increasing number of available ingredients for feed formulation and the competition from other industries (biofuels, food, etc), it becomes more and more important to have precise information about each ingredient in order to use them to the best effect.

There are currently three ways for evaluating the energy value of feed ingredients:

- Digestible energy (DE).
- Metabolisable energy (ME) .
- Net energy (NE).

Whilst many feed producers worldwide have been using NE systems for several years, the Vietnamese feed industry mainly uses the ME system.

Jean detailed the accuracy of the NE system in comparison to DE and ME measures, and stressed the profitability of this system for feed compounders.

Indeed, Jean's research work has highlighted that digestible energy is influenced by several criteria such as the physiological stage of the pig (different energy values are used for piglets, growing pigs and reproductive females), pelleting or the nature of the ingredient.

DE and ME systems were shown to underestimate the energy values of fat and starch rich ingredients, whilst they tend to overestimate energy values of protein rich ingredients. In this context, the net energy system appears to be much closer to the final use of energy, and a much better predictive model for feed formulation.

Another aspect to consider is the value of protein in pig feeds. Regarding this, Jean reminded the audience that of the two main systems used to evaluate protein digestibility, namely apparent ileal digestibility and standardised ileal digestibility (SID), the latter is preferred.

Indeed, SID values are independent of the crude protein content of the feed and are supposedly identical at all physiological stages.The SID concept has been accepted at international level.

Knowing this, he stressed the fact that diets should be formulated first below the maximum protein levels defined for each physiological stage (European standards), then taking into account the ratio between SID lysine and net energy, and finally adjusting ratios of SID amino acids (threonine, sulphur containing amino acids, tryptophan and valine) and SID lysine.

The use of feeding tables is necessary, and there are as many feeding tables as there are nutritionists!

Whatever their quality, they all have the same limitations: they give mean values for 'typical' ingredients, not taking into account the existing variability from one batch to another.

To make up for these inaccuracies, Jean recommends the use of INRA developed software EvaPig1, specially developed to deal with these issues.

Protein requirements

The second topic of the seminar addressed the issue of the protein and energy requirements of reproductive sows.

The sow's productivity has considerably increased over the last 30 years in Europe, with larger litters, heavier piglets, along with a shorter time for recovery between pregnancies.

It is then crucial to support this change by adjusting the sow's feed to their current needs. One of the challenges is to provide, in the same feed, adequate amounts of proteins and energy.

Gestating sows have three uses of energy: maintenance, uterine growth and reconstitution of body reserves used during lactation. Their needs will greatly vary depending on body weight and external factors such as temperature, housing or behaviour.

Moreover, it appears that primiparous sows have different protein and energy requirements compared to multiparous sows, leading to a higher lysine to energy ratio in the first gestation. Indeed, the diet profile of pregnant gilts is closer to that of growing pigs' diets.

The sow's body condition at mating does not influence energy and lysine requirements in the diet, but lean sows will need more feed than fat sows.

Jean also highlighted the fact that due to the exponential development of the foetus during gestation, lysine requirements are much higher in late gestation compared to early gestation phase (+50% in average).

Thus, two different feeding phases could be considered: one for the first two thirds of gestation and one for the last third of gestation.

When it comes to lactating sows, milk production is very hard to evaluate and is estimated through the growth of the litter. Therefore, lactating sows' requirements are directly related to the litter performance.

Energy requirements are much higher for sows in lactation compared to gestation (up to four times more). This is linked with much higher requirements of production (milk).

As a consequence, it is largely influenced by litter growth (reflecting milk production), and also sow weight: it doubles from a light sow with low milk production to a heavy sow with very high milk production.

Following the example of gestating sows, lactating gilts have different requirements compared to sows; lower energy and higher lysine requirements, and so should be fed differently.

Consequently, the ideal feeding program for reproductive females should involve six different diets: one for early gestation, one for the end of gestation and one for lactation, for gilts and sows respectively.

Jean stressed that such a strategy could be implemented successfully in large farms with high productivity performance, but it is not cost effective on small units. To help farmers and formulators optimise ingredient use, INRA has developed a software package, InraPorc2, which helps analyse performance and evaluate nutritional strategies in sows and growing pigs.

High temperatures

The last issue to be addressed was the impact of high temperatures on sows.

While gestating sows are not so sensitive to climatic conditions in terms of nutritional requirements, it is clear that lactating sows easily suffer from heat stress. They are most comfortable at temperature of around 15°C.

Above this temperature, their respiratory rate increases (from 30 rate/min at 16°C to 120 rate/min at 30°C), to increase evaporative heat loss.

There is a direct effect on feed intake as well, impacting on milk production, body reserves and in the end litter growth and reproductive performance.

This phenomenon is amplified in countries with high hygrometry such as Vietnam, despite sows showing some adaptation to the extreme climate. Different solutions exist to solve this issue.

Low crude protein diets have shown to improve sow feed intake under heat stress.

In this, it is advantageous to use net energy as the basis for formulation as it tends to decrease the crude protein content of the diet.

Moreover, sows should be fed early in the morning when the temperatures are lower, and extra water should be supplied to aid digestion and reduce heat stress.

The seminar was well received by attendees, including nutritionists, formulators, scientists and technicians. Olmix organised a second session later in the week in Ho Chi Minh City. This seminar was attended by over 90 people coming from Vietnam and other South East Asian countries. ■