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Exploring net energy (NE) and amino acid (aa) balance in Irish pig diets



Key external stakeholders:

Pig farmers, nutritionist, Teagasc advisors DAFM

Practical implications for stakeholders:

- The diets currently used in Irish pig farms are formulated above the requirements of the pigs and the feeding plans use diets beyond age/weights recommended. This results show how this feeding plans should be modified.
- Formulation of diets using the net energy (NE) and digestible amino acid system (SID aa), and ingredients commonly used in other countries like corn or rapeseed allows formulating cheaper diets with the same production efficiency.

Main results:

- A survey of diets and feeding programs in Irish pig farms showed that diets used from weaning to slaughter include levels of crude protein (CP) and SID lysine that are too high when compared to the requirements of the pigs.
- Partial replacement of soy bean meal with rapeseed and field beans proved to be a viable option with no effects on production cost although it did have an effect on FCR of 0.1. Important savings would be expected when soy prices are increased.
- Reductions of 1 MJ/kg of NE and 4% of CP resulted in increases of FCR of 0.2. However these increases in FCR had no effect on profit for diets formulated on NE & SID Lys bases. Diets formulated with lower NE & CP levels actually reached costs that were lower in 0.01-0.03 euros/kg carcass.
- Reductions on NE and SID lysine combined induce a reduction on growth (50 g/pig/day) and a longer time to slaughter. However the cost of production was reduced in 0.02 to 0.04 euros kg carcass. The use of the low spec diets as a second diet after 60kg in a phase feeding program had no effects on production efficiency and resulted in lower costs.

Opportunity / Benefit:

Formulating diets using NE and SID amino acids has demonstrated to allow for reductions in CP and Lys level and for the use of new ingredients. This study has demonstrated no economic benefit over the use of soybean meal in a situation with low soy and cereal prices however the benefits can go up to 25-30 euros per ton of feed in cases of high feed prices.

Collaborating Institutions:

UCD

Teagasc project team: Dr. Edgar Garcia Manzanilla (PI)
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External collaborators: Professor John O'Doherty, UCD

1. Project background:

Since the introduction of the NE system in swine nutrition, different approaches have been taken by different countries. The NE concept is something applicable everywhere but must be adapted to each region's practical conditions. Two main systems are available and fully developed in commercial practice. right now; the French system (Noblet et al., 1994; INRA-AFZ-INAPG. 2004) and the Dutch system (CVB 1994, 1998, 2003, 2011); the French being more focused on the use of regionally produced ingredients and the Dutch focused in the inclusion of by-products in the formulation. A third system would be the Danish system which uses Scandinavian Feed Units but this is a different approach based on the physiological energy value of the ingredients.

Countries with swine diets based on soy and corn like the USA were initially not very interested in systems based on NE. However, as a result of producers being interested in the potential benefits significant research in this area started in 2000. The approach in the USA is different than the French and the Dutch as soy and corn are US national products and moving to a NE system there would offer less benefit there. In Ireland, home compounders currently use simple soy cereal based diets while compounded feed is formulated on a least cost basis and contains by-products and other ingredients as they offer financial value in the diet. Moving to a Dutch or French NE system could certainly offer advantages where diets are formulated on a true least cost basis. However Ireland does not have an ingredient evaluation research structure as the France or the Netherlands do and so we will have to rely on the information available from those systems.

Once a NE system is considered, it should be paired with an improvement in the aa formulation of the diets. The use of standardize ileal digestible (SID) aa instead of simply relying on total aa content is key in order to optimize diet formulation and reduce the protein content of the diet. Both the French and the Dutch systems normally provide table values for ingredients to be included in the formulation.

2. Questions addressed by the project:

- Are Irish diets formulated as least cost following pig requirements?
- Can pig diets and feeding programs be improving by using the NE SID amino acid system to reduce feeding costs?

3. The experimental studies:

This project included a survey of diets used in Irish pig farms in all production stages and 4 experimental studies using diets based on the formulations found in farms.

The first experiment included 2 different levels of energy and lysine and used rapeseed and field beans as new ingredients that should be included in Irish pig diets.

The second experiment studied the effects of protein and energy level on growth and production efficiency.

The third experiment studied the effects of lysine and energy level on growth and production efficiency.

The fourth experiment studied the effect of phase feeding on production efficiency.

4. Main results:

- The survey of diets and feeding programs in Irish pig farms showed that diets used from weaning to slaughter include levels of crude protein and SID lysine that are too high when compared to the requirements of the pigs.
- Partial replacement of soy bean meal with rapeseed and field beans proved to be a viable option with no effects on production cost although it did have an effect on FCR of 0.1.
- Reductions of 1 MJ/kg of NE and 4% of CP resulted in increases of FCR of 0.2. However these increases on FCR had no effect on profit for diets formulated on NE & SID Lys bases. Diets formulated with lower NE & CP levels actually reached costs that were lower in 0.01-0.03 euros/kg carcass.
- Reductions on NE and SID lysine combined induced a reduction on growth (50 g/pig/day) and a longer time to slaughter. However the cost of production was reduced in 0.02 to 0.04 euros kg carcass. The use of these diets as a second diet after 60kg in a phase feeding program had no effects on production efficiency.

5. Opportunity/Benefit:

The current study has demonstrated that large amounts of protein and amino acids are wasted in Irish pig diets and more accurate formulation and ingredient evaluation could result in important benefits. Also the use of diets for longer than recommended results in serious losses. Diets should be adapted to current growth rates of pigs and dimensions of farms should be reviewed.

6. Dissemination:

During the life time of this project the results have been extensively used in 2 Teagasc Pig Dissemination Days, 3 Teagasc Pig Farmer's Conferences and 5 discussion groups. The results have been also used for the development of the Teagasc Pig Production Model which is based on a nutrition engine.

In addition to scientific and popular press articles, 2 workshops were organized to present the French and Dutch to Irish pig nutritionists. The research results were also disseminated via in-service training to Teagasc Advisory staff annually.

Main publications:

2 papers still in preparation:

Dudley SL, O'Doherty JV, Lawlor PG, Manzanilla EG. The effects of low crude protein diets supplemented with different levels of artificial amino acids on growth performance, carcass characteristics and nitrogen balance of grower-finisher pigs.

Dudley SL, O'Doherty JV, Lawlor PG, Manzanilla EG. Manzanilla. Effects of replacing soybean meal with rapeseed meal and field beans on growth performance, carcass characteristics and nutrient digestibility of grower-finisher pigs of two different genetic lines.

Popular publications:

Manzanilla EG 2014. Benefits of NE utilization for pig diet formulation. Teagasc Pig Farmers Conference.

Manzanilla EG, Lawlor PG 2015 An update on research activities on feed and feeding practices. Teagasc Pig Dissemination Day.

Manzanilla EG 2016. Optimizing the flow of pigs for a better Health and feed efficiency.

Manzanilla EG, Lawlor PG, Dudley SL, Rodrigues da Costa 2017. Effects of feeding practices and energy and protein formulation on Irish pig performance. Teagasc Pig Farmers Conference.

Manzanilla EG 2017. Energy and protein in Irish pig diets – A discussion with farmers. Teagasc Pig Dissemination day.

Manzanilla EG 2018. Adjusting your feeding program for finishers. Teagasc Pig Farmers Conference.

7. Compiled by: Dr Edgar Garcia Manzanilla
