UK feeding strategies for new genetic lines

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As with all inputs into agriculture pig genetics responds to market requirements. However, unlike many other inputs, such as feed, the rate of change possible in genetics is relatively slow. Breeding companies select for desired traits over a number of generations, with selection pressure being applied to traits according to their perceived economic value. Breeding companies can spend large sums developing a particular trait only to find that the market has 'moved on' and the value of this trait has diminished.

In the late 1970s and early 1980s the major determinants of pig profitability for many producers was FCR, as feed represented 70% of costs, and backfat (with the advent, in particular, of the 12mm contract for rind-on bacon).

This was allied to a change towards ad lib feeding to improve growth and reduce labour costs. Many existing pig genotypes just could not achieve the grade on ad lib feeding and this was brutally spelt out in the MLC commercial pig evaluation (CPE) trials. Four breeding companies were evaluated anonymously.

Evaluation trials

There were differences in P2, using meat type sires, from 10.7-15.4mm, in gain from 774-858g/day and in FCR from 2.45-2.87. The company achieving the best carcase had an acceptable growth rate but intake was about 10% lower than some of the other genotypes.

Grading was 'king' and low appetite, high lean tissue growth rate genotypes, dominated the market. There were downsides to this low appetite as the females struggled in lactation and were more difficult to manage.

With time traits and selection pressures changed. Sow productivity was included, initially as litter size but eventually as sow lifetime productivity. Many companies included meat quality. As feed became cheaper, and abattoir contracts changed, selection pressure on feed efficiency and leanness was reduced.

Differing selection pressures were applied to male and female lines.

Methods of selection also became increasingly complex. Phenotypic selection was improved by BLUP, and then by EBV's. DNA technology then became available and was included in the selection. Finally, some have adopted CBV's where commercial farm results are included in the selection database.

Growth rate 30-100kg	700	800	900
Apparent feed intake* (kg/day)	2.01	2.01	2.12
Bodyweight range (kg)		**Digestible lysine (%)**	
30-60	1.01	1.04	1.08
60-90	0.80	0.85	0.91
90-120	0.64	0.71	0.79

* includes 5% wastage. Feeds formulated at 9.8, 9.4, 9.2 MJ NE/kg

Table 1. The BSAS nutrient requirement standards of pigs.

Unique development

So the UK developed genetically somewhat uniquely, particularly with regard to sire-lines. These were mainly of white origin, with some Duroc used for meat quality improvements.

International comparisons by the MLC revealed that UK growth rates were increasingly falling behind. Comparisons of nutrient standards conducted as part of the BSAS Nutrient Requirements of Pigs indicated that feed intakes in finishing in the UK were over 20% lower than in many other EU states. Whilst the use of entire pigs, health and building quality all contributed, genetically our pigs were clearly 'low appetite'.

We then, unfortunately, had a major problem with 'wasting disease' with mortality reaching 30% in growing pigs and 15% in finishing. Improving management and hygiene helped to some extent whilst veterinary interventions helped control secondaries.

Limited success

Overall though the success of such measures was limited. Restocking was more successful, together with batch farrowing and batch finishing. Increasingly, there were comments from other countries that genetics were important, although there was confusion though as to which genetics gave greater resistance.

The extent of 'wasting disease' in the UK suggested to some that our pigs had low resistance although poor housing and general disease status in the UK were clearly also major factors.

Finally, abattoir contracts were on the move with the advent of heavy pig contracts allowing pigs up to around 90kg deadweight with 14mm P2. For years we had selected pigs for optimum performance at 90-100kg liveweight. Indeed most genetic evaluations were up to 90kg; many UK genetic lines were not even characterised at higher weights.

This had resulted in the UK having relatively early maturing genotypes which by definition 'stalled and ran to fat' at higher weights.

Other countries such as Germany, France and the USA had been producing heavier carcases for years and, thus, had developed later maturing genetics and sires that might be more useful for some of our market requirements.

Higher yield selection

A further development was the selection by integrated companies of breeding stock that had higher yields, particularly of the more valuable cuts. The installation of the Autofom at Adams, with the possibility of payment switching from P2 to lean meat/confirmation, added to this interest.

So the position a few years ago was that we generally had low appetite pigs, that

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grew slowly but graded well (at least as measured by P2), that they were early maturing and thus unsuitable for heavy pig production, and that their conformation was 'average'.

Further, there was the suspicion that the pigs were not robust and were particularly susceptible to wasting, for example, compared to some continental sires.

Things were about to change. The breeding companies, responding to a changing market, bought in European and North American sirelines generally based upon the Hampshire or the Pietrain

The results were dramatic, often exceeding the claims of the breeding companies. Growth rates in finishing improved on commercial farms by as much as 100g/day with no, or only a small, increase in backfat. But equally dramatic were the reductions in mortality.

Wasting disease by this time had generally moved away from PMWS in the weaner to PDNS mortality in finishing, with many herds being hit with a 6-8% mortality at around 60kg bodyweight. The new sires reduced this to 2-4%.

Furthermore, these improvements were evident on the vast majority of farms who tried the new sires.

We now see in breeding company literature terms such as 'maximum heterosis' and 'robustness'.

Progeny of these sires are indeed more resistant to wasting and other ailments.

It is not the purpose of this article to look at genetics per se but some familiarity with the breeds/lines available is necessary before considering feeding specifications.

The Hampshire has proven to be very popular as a terminal sire. The term 'Hampshire' in itself is not particularly helpful, as it is the selection pressure applied to various traits over a number of generations that dictates its value to the commercial producer.

The Hampshire that has delivered in the UK is the PIC 327 Hampshire. It is clearly late maturing, and thus suitable for heavy pig contracts, grows very well in finishing, and is arguably the most robust sire.

The conformation of the Pietrain is exceptional and it has a very high carcase yield. It is favoured in Germany where these characteristics command a premium. It significantly increases processor loin and ham yield. Progeny appear robust.

As a breed the Pietrain is generally early maturing and thus less suitable for heavy weights. However, there are huge differences between, for example, Pietrain from Germany, France and Australia presumably reflecting selection pressure applied over the years. In the UK Pietrain hybrids or synthetics command greater sales than purebred sires. For example, PIC generally suggest the PIC 327 Hampshire or PIC 337 (synthetic containing Pietrain) for heavy contracts and not their 408 Pietrain.

Hermitage favour a Duroc Pietrain (MQM). JSR suggest that their Titan is 'specifically bred to allow progeny to be taken to higher slaughter weights'.

It is evident that the term 'Pietrain' is not particularly useful to the nutritionist in order to try and define a pig type. We must try and define the specific line with the help of the breeding company that developed it. There remains the suspicion that used as a pure terminal sire that progeny will be early maturing.

Feeding strategies

When deciding upon a feeding strategy, what do we ideally need to know? The most important parameters are:

- Feed intake.
- Lean tissue growth rate curve.

In addition, we might like to take P2 into account, including the relationship between P2 and lean, and heterosis. In reality, it is unusual to be presented with a lean tissue growth rate curve so we need to estimate this from growth rate curves (again assuming they are available). We also need to remember that the sire is only half of the equation. Another point is that there is a significant difference in killing out percentage among the lines.

Our requirements models generally work on a carcase basis and then convert to live using a nominal killing out percent (the new sires are generally all high killing out so nutrient requirements would be underestimated).

It would be great if having collected such data you could then produce definitive specifications for say progeny of the PIC Hampshire. Of course this will never be the case as the very parameters that we have defined above as being fundamental to setting up the feed specifications are not only genetically controlled but are a function of the farm.

On commercial farms we rarely exploit 70% of genetic potential. Disease in particular reduces lean tissue growth rate. We also have to consider that we are feeding a population of pigs, often in large groups, particularly when using nutritional models.

We need to set up specifications commensurate with the growth rate we are trying to achieve on the farm, taking into account farm characteristics and genetics.

The BSAS nutrient requirement standards of pigs summarises the calculation of the nutrient requirements of a single pig. The MLC leaflet 'feed formulations for pigs' (hereafter referred to as the standard) offers a practical interpretation of these standards, attempting to cope with a population and including some safety margins.

Inevitably, the application of this factorial approach on individual pigs to commercial farms requires a number of assumptions. It is thus pertinent to enquire:

- Are the standards robust?
- Are they applicable to the new sires and if not how do we modify the specifications?

Recent trials

A useful series of trials has recently been published by Teagasc and Moorepark (O'Connell, Lynch, O'Doherty, 2006). In these trials graded levels of lysine were fed to pigs from 20 to 100kg, in 20kg stages approximately, and lysine requirements were determined by regression.

The feeds were formulated to the same digestible energy but high lysine feeds were much higher in crude protein and were, therefore, lower in net energy. Hermitage breeding stock was used with sires being Hylean Landrace and 'meatline sires'.

Daily lysine requirements, at similar growth rates, were higher than those proposed in the standard by about 2g/day over the weight range tested.

However, these trials were looking at maximum response by regression, whereas the MLC document introduced an economic parameter aiming at feeding 83% of the population their amino acid requirements. Taking this into account the requirements are in excellent agreement. The data from the Moorepark trials also yields some other interesting points:

- There is little difference in the performance of boars and gilts up to 70-80kg but, thereafter, it is increasingly large and, at least from a nutritional standpoint, a higher lysine feed for boars would be justified.
- In each trial performance deteriorated once the amino acid requirements for growth were exceeded. Presumably this is largely due to reductions in net energy. Perhaps too often commercially we estimate requirement and 'add a safety margin' without considering the downside.
- Despite a very wide range of protein and lysine levels fed there was no significant effect on feed intake.
- Changes in P2 with increasing lysine were significant but not dramatic. Often commercially a high lysine/protein feed is suggested at higher weights to improve grading. These trials confirm that, at least in a thermo neutral environment, the success of such a strategy is limited.
- Lysine conversion rate was about 25g lysine/kg gain (higher at heavy weights).

Applicable to new sire lines

The standards estimate amino acid requirements for three example growth rates, using protein growth curves. That used for pigs growing at 920g/day has a maximum protein retention (Pr) of 200g/day, reached at around 80kg bodyweight, with a decline of only 15g/day by 120kg liveweight.

This is clearly late maturing and, as such, is suitable for the PIC 327 Hampshire. Farm application has shown that these recommendations are robust for 327 progeny grown at these rates (providing of course that they are adjusted to farm intakes).

As suggested earlier the age at maturity of Pietrain or Pietrain cross progeny is likely to be lower than that of the 327 and is line specific. If the particular line under consideration is early maturing then, whilst still achieving overall 920g/day in finishing, it will, by definition grow quicker initially and slower at higher weights.

Thus, the feeding schedule should supply a higher daily intake of amino acids initially, and a lower intake at higher weights, than in the standards.

As a simple rule of thumb then adjusting the standards to the desired growth rate at various weight ranges using the 25g lysine/kg gain from the Moorepark research may be useful, for example, if we believe the pigs are likely to grow 100g/day faster from 30-60kg then supply an extra 2.5g lysine/day than in the standards.

It should also be remembered that energy intake can reduce lean growth and an increase in energy concentration in this early feed for early maturing genotypes, particularly where intakes are low, may be advantageous.

The standards for a pig growing at 700g/day suggest a pig with a maximum Pr of 150g/day, achieved at 70kg, with a 36g/day decline in Pr up to 120kg.

This does not define a genotype – it defines the protein growth of a pig heavily compromised by disease and other stresses.

Thus, the question of feeding the genotype becomes less relevant than an understanding of what is happening on the farm in terms of health and other challenges. For example, the mixing and transporting of pigs at 35-40kg may result in growth checks and disruption in Pr and feed intake for the first couple of weeks.

Late mortality with PDNS clearly has a major impact on some individuals in the herd whilst leaving others virtually untouched – the population becomes more diverse in its nutrient requirements.

Disease alters nutrient requirements, for example, amino acid balance and vitamin E status, but our knowledge in this area is limited. Further, disease status is continually changing.

So are the standards robust for diseased pigs growing at 700g/day? By definition they will never achieve the accuracy that we see on higher health units, on which the standards are based and where on farm abuses are minimised.

A further consideration is why would you want to define a feeding strategy for such a relatively poor growth rate? If improvements are made to health then nutrition will soon become the limiting factor to growth.

Personally I prefer to 'lead feed' and thus rarely set up feeding strategies for less than 800g/day in finishing.

So, finally, should the standards be changed for the 800g/day herd for the new sires? Here we have an intermediate position with more genetic potential being expressed but still a significant disease impact. Again we need to model against growth rate required at farm level but it may be that the daily amino acid intake required at higher weights for PIC 327 Hampshire progeny is higher. Conversely, particularly with pure Pietrain, the requirements may be higher at lighter weights than in the standard.

Final comment

Nutrition standards are no more than a benchmark – a 'best stab' for a mythical average farm. They must never be seen as definitive. Ideally, nutritionists should develop a feeding strategy, and then revise it in the light of results obtained.

It is, therefore, helpful to have some data back from the farm – intake and growth rate would seem to be particularly fundamental!

All too often we have no intake figures, and often only a growth rate from birth to slaughter.

This article is looking at refining our feeding strategies. For most farms an article entitled 'Lets get the basics right' might be more useful with a determined effort to increase the level of farm recording. ■

This article was first presented at the SFTEurope Pigs November 2006 meeting.