Better production with Betafin

*by ERKKI VIRTANEN, MALCOLM MOTTRAM and TONY EDWARDS**

Betafin improves the cost-efficacy of pig production - by improving the conversion of dietary energy to lean tissue and reducing the need for methionine and choline supplementation.

Betaine is a molecule with two functions in an animal's metabolism: It is a direct source of methyl groups and plays a major role in the maintenance of osmotic balance. As a methyl donor, betaine converts homocysteine to methionine, and also supplies methyl groups to many essential body constituents, such as carnitine, creatine, RNA/DNA and phospholipids. A novel finding, confirmed by extensive research, is that betaine supplementation improves energy conversion in pigs.

Earlier research demonstrated that betaine as a lipotrope may reduce fat accumulation in finisher pigs. Recent research confirmed that betaine increases the muscle content of carnitine and carnitine-fatty acid complex, a factor behind improved fat utilisation and reduced fat deposition.

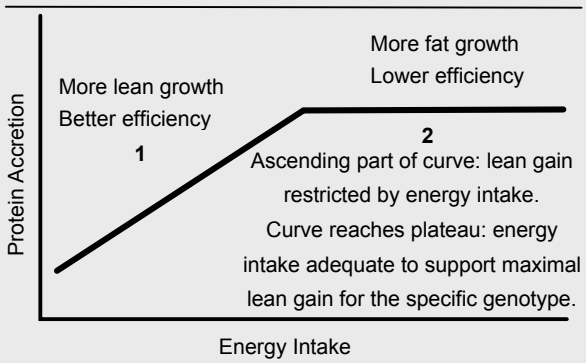
Betaine may also promote lean gain through improved methionine status, if methionine is limiting. However, the effects of betaine were shown to not only depend on the methionine status of the diet, but even more on the adequacy of energy intake to meet maximal lean gain.

The relationship between energy intake and protein deposition in pigs has been extensively documented. Energy intake inadequate to meet the needs for maintenance, heat production and lean deposition results in increased protein catabolism and less efficient utilisation of dietary protein for lean deposition.

Under such circumstances, improved energy availability results in increased lean gain, provided that essential amino acids are not limiting. Each genotype has a maximum potential for lean deposition, and when the potential is reached, improved energy availability can only increase fat deposition (fig 1).

Finnfeeds together with our research partners initiated a few years ago a research program to clarify the interaction between energy intake and betaine effects. One of the first studies reported that betaine supplementation of growing male pigs decreased the maintenance energy requirement by ca.10 %. This study was run using four different feeding levels, and measuring nutrient deposition rates based on whole-carcase assays.

Figure 1: Effects of improved energy availability on protein accretion in pigs.

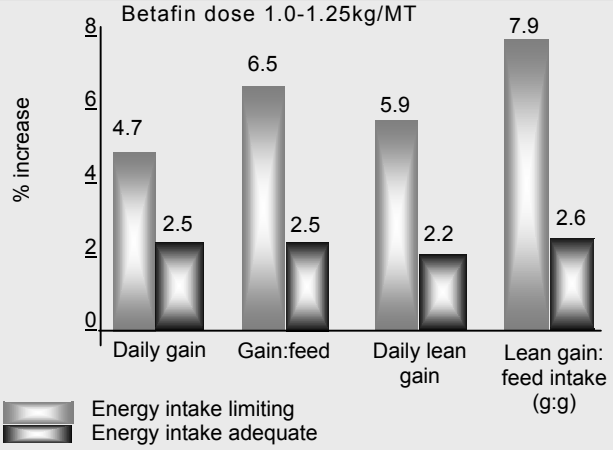


Recently, several experiments have been carried out to investigate betaine effects with adequate vs. inadequate energy intake. Energy intake was restricted either by reducing dietary energy content or restricting feed intake. The energy intake in restricted pigs was 12.5 % less than in the non-restricted ones, as an average.

Fig 2 illustrates that the effects of betaine supplementation on the gain, feed efficiency, lean gain and lean efficiency in finisher pigs is highly dependent on the energy intake. While energy-adequate pigs showed minor responses (ca. 2 %) to betaine supplementation, betaine markedly (by 6-8 %) improved the overall and lean efficiency of energy-restricted pigs.

In addition to improved energy conversion, Betafin supplementation provides an opportunity in sparing methionine and choline. Pigs do not have a specific requirement for choline but can meet their choline requirement through endogenous synthesis if methyl group supply is adequate. Hence, no supplemental choline is needed when Betafin is added at a sufficient rate. In contrast to betaine, supplemental choline appears not to have an effect on energy conversion (fig 3).

Figure 2: Effects of betaine supplementation on energy-restricted and non-restricted finisher pigs.



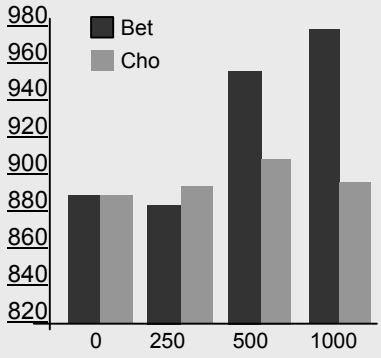
Data from five trials, with an average intake of digestible energy of 37.6 vs 43.0MJ/d in the energy-restricted and non-restricted pigs, respectively.

The methionine sparing capacity of betaine is dependent on several factors, including dietary methionine and cystine, dietary methyl donors in general, and the magnitude of methionine use for methylation. In

Reproduced with permission of Milne's PORK JOURNAL, May 2000

contrast to poultry, cystine intake is typically close to cystine requirement in grower-finisher pigs, hence most of methionine used for methylation

Figure 3: Daily gain g/d



can be recirculated back to methionine.

As a practical approach, it is possible to utilise both the energy "boosting' and methionine/choline sparing possibilities with a single dose of Betafin. Commonly Australian diets and feeding regimes in the finisher phase may result in sufficient energy supply, hence lowering the energy specification of the diet tends to be the most appropriate choice to optimise Betafin use.

In a recent trial Betafin was formulated into a practical grower/finisher diet, which was "down-specified" by reducing 100kcal per kg net energy (0.6 MJ/kg DE) and removing all supplemental methionine (250 g/t) and choline chloride (250 ppm cho-cl-70).

The standard commercial diet contained 2293 (13.7 MJ/kg DE) and 2228 (13.3 MJ/kg DE) MJ NE and 0.51 % and 0.44 % digestible sulfur amino acids in the grower and finisher phase, respectively. The reformulated diet contained 2194 (13.1MJ/kg DE) and 2130 (12.7 MJ/kg DE) MJ NE and 0.025% less methionine and was supplemented with 0.1% Betafin. Eighty Seghers hybrid x Pietrain pigs were used in two experiments, one run to a final body weight of 100kg and the other one to 120kg.

Table 1 shows the growth and carcase performance of the pigs fed the commercial positive control or the down-specified diet with Betafin, with the two experiments combined. The data show that the Betafin diet produced improved gain in barrows, while the growth in gilts and carcase quality in both genders was similar. The cost of the reformulated diet was ca. $3.30/MT less than the conventional one.

Table 1: Growth and carcase performance

	Barrows		Gilts	
	Control	Downspec+ Betafin	Control	Downspec+ Betafin
Daily gain (g)	759	824	699	701
Daily feed intake (g)	2260	2280	1980	2000
Gain:feed	0.334	0.360	0.357	0.351
Backfat, mm[1]	23.6	23.7	21.1	20.7
Meat %	57.2	57.8	59.5	58.6
Meat pH[1]	5.43	5.49	5.47	5.52
Drip loss[1]	3.2	3.5	4.1	3.2
Moisture loss, mg[1]	55.9	55.4	61.0	47.4

[1]Values corrected for sex distribution and body weight.

Practical implications

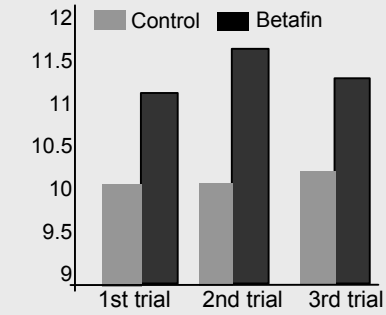
Betafin supplementation appears to be an effective way of improving energy utilisation in grower/finisher pigs. In pigs fed low-energy diets or restricted in feeding, performance improvements can be expected, provided that the diet supplies sufficient amino acids to utilise the improved energy availability for lean growth.

This approach is especially useful for genotypes with high lean gain potential but typically low intakes - a common situation in Australian production systems, especially during summer. While boars are more likely to be energy-restricted than barrows or gilts published data and research has also shown that lactating sows can benefit from Betafin.

Lactating sows often lack sufficient intake to support energy demand which can have a negative effect on the reproductive performance in subsequent parities, especially during summer. As can be seen in figure 4. by adding Betafin to the lactating diet litter size, on average, has been increased in the subsequent litter by 1 piglet/litter. This payback is 15-20 times the cost of adding Betafin to the lactating sows' diet.

In many cases commercially the most economic use of Betafin is to reduce the energy specification of the diet. Energy down-specification of up to 5 % is possible. Removal of supplemental choline and reduction in methionine specification are other means to lower the formulation cost, whilst still keeping the same growth performance and obtain the improved carcase characteristics previously associated with the use of Betafin. This approach is most likely to be applied to gilt and castrate diets, or where pigs have high-energy intakes.

Figure 4: Betafin and sow performance



- Three consecutive trials at Bunge Meat Industries, 120-160 sows in each.
- Betafin used at 2kg/t in the commercial lactation diet.
- All trials demonstrate increased litter size in the subsequent farrowing.
- P-values: 0.027, 0.048, 0.061.

** Erkki Virtanen is Betafin R&D manager at Finnfeeds, Marlborough UK, Malcolm Mottram is sales director for Feedworks P/L, Ascot, Qld, and Tony Edwards is a consultant nutritionist, ACE Livestock, Cockatoo Valley, SA.*

Key Words: Betafin (swine), Betafin, Betaine, pig, swine, energy, sparing, downspec, lean meat, methionine, choline, cysteine, methyl donor, backfat, litter size, sow.