REVIEW OF NUTRITIONAL REQUIREMENTS OF A MODERN LEAN GENOTYPE

Report prepared for the
Co-operative Research Centre for an Internationally Competitive Pork Industry

By

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FEEDLOGIC Experiment 2

Introduction

Genetic selection for lean tissue growth rate and lean tissue feed efficiency has changed the metabolic status of modern pigs. These genetic improvements have made modern genotypes more sensitive to nutrition than their predecessors. In addition, selection for lean tissue feed efficiency has inadvertently resulted in animals with lower voluntary feed intake. Despite these genetic advancements, current nutritional recommendations for most genotypes are conservative and reflect research undertaken more than 20 years ago on far less efficient genotypes. Improvement in efficiencies could be gained by assessing alternative feeding strategies designed to suit modern lean genotypes.

The first experiment in this program investigated the effect of available lysine to energy ratio on pig performance. Basal diets were blended to produce ten dietary treatments – five lysine levels (7 to 11g/kg) at each of two energy levels (13.8 vs 14.6 MJ DE/kg). Energy level did not affect any of the parameters investigated – average daily gain, average daily feed intake or FCR.

A curvilinear response in average daily gain was observed in response to increasing lysine level - a linear plateau response would be expected whereby daily gain increases with increasing lysine content to a genetically determined level above which it remains constant. Based on the observed response it was concluded that the maximum daily gain achievable by that genotype was not reached and that further improvements could be made with higher lysine levels.

The aim of this experiment was to investigate the response of growing pigs in a commercial environment over a range of available lysine levels from 8-14 g/kg and a single energy level of 14.2 MJ/kg.

Methods

Diets

The investigation into the effect of available lysine to energy ratio on pig performance was based on the results from experiment 1. Two basal diets of equal energy level but differing in lysine level were formulated (Table 1) and subsequently blended to produce five dietary treatments (Table 2.) Full diet formulations can be viewed in Appendix I.

Table 1. Specifications of two basal diets.

Diet	Name	MJ DE/kg	Total Avail Lys g/kg
1	McLean Farms Grower 1 Feedlogic 08-02-08	14.2	8.0
2	McLean Farms Grower 2 Feedlogic 08-02-08	14.2	14.0

Table 2. Blend ratios of two basal diets to produce five dietary treatments.

Treatment	Diet 1	Diet 2	MJ DE/kg	Total Avail Lys
1	100		14.2	8.0
2	75	25	14.2	9.5
3	50	50	14.2	11.0
4	25	75	14.2	12.5
5		100	14.2	14.0

Pigs and feeding

The experiment utilised approximately 1000 pigs grouped (4 pens/treatment) on the basis of age at entry (the two sides of the shed were filled a week apart, with one weeks age difference between sides) and size (pigs were boxed by size). The FEEDLOGIC delivery system was used for feeding. Feeders were filled to capacity on the first day of the experiment (Tuesday, 12th Februrary) with the allocated dietary treatment and an attempt was made to maintain the feeders at full capacity for the duration of the experiment so that daily feed consumption could be recorded. A periodic error with the delivery of feed on one side of the shed (negative numbered feeders) resulted in some interruptions to feed availability, however, total feed consumed over the period was not significantly different between sides ($p>0.05$). These feed interruptions appear to have contributed to variable responses in ADFI, FCR and ADG response. At the experiments completion, on the 27th of March (44 days after its commencement), the pens were reweighed. Any residual feed left in feeders on the final day of the experiment was removed and weighed. Responses measured included average daily gain, feed intake and FCR.

Statistical analyses

To determine whether shed side (as a result of feed interruptions) had an effect on response to the different lysine levels a two way ANOVA was conducted. Regression analyses were then applied to determine the model that best described response of average daily gain to lysine. All analyses were conducted using Genstat 10th Edition.

Results

Whilst differences occurred, shed side did not have a statistically significant effect on the average daily gain (Figure 1), average daily intake (Figure 2) or FCR (Figure 3) response to dietary lysine level. Regardless, this may simply reflect a lack of statistical power for this non pre-planned comparison and based on the knowledge of feed interruptions and the erratic response, it is hard to justify pooling the data (even when pooled, the high degree of variation and low level of replication results in a lack of statistical difference in response). A better approach would be to examine the trends observed for the positive side of the shed.

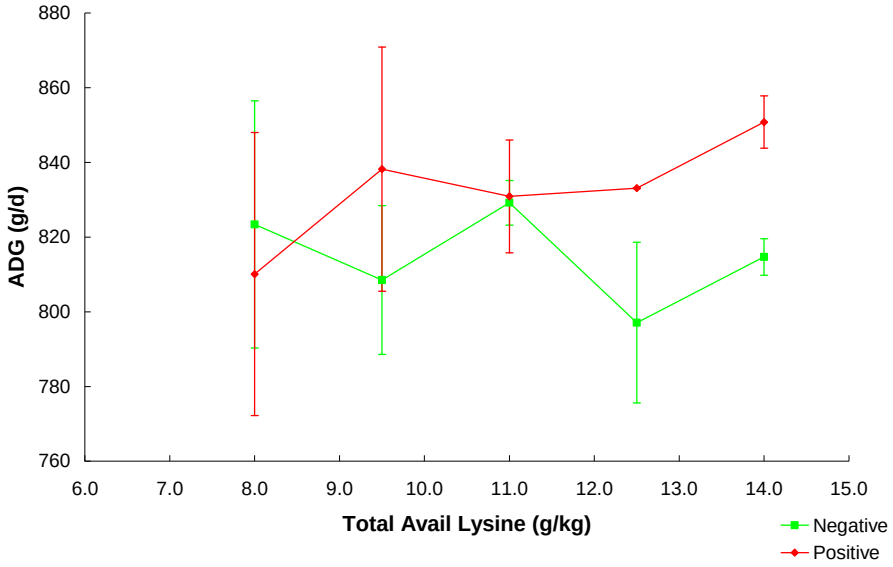

Figure 1. Average daily gain (g/day) ± SE.

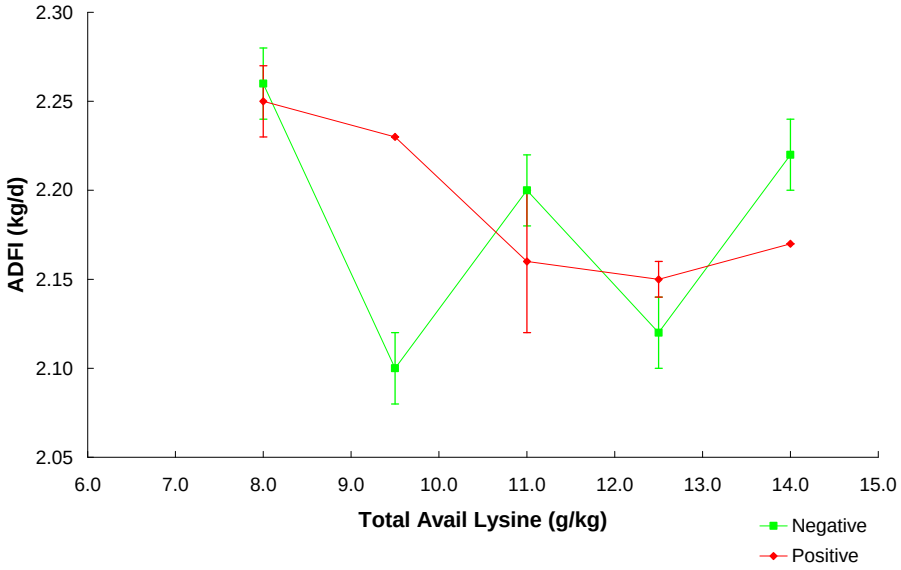

Figure 2. Average feed intake (ADFI) (kg/day) ± SE.

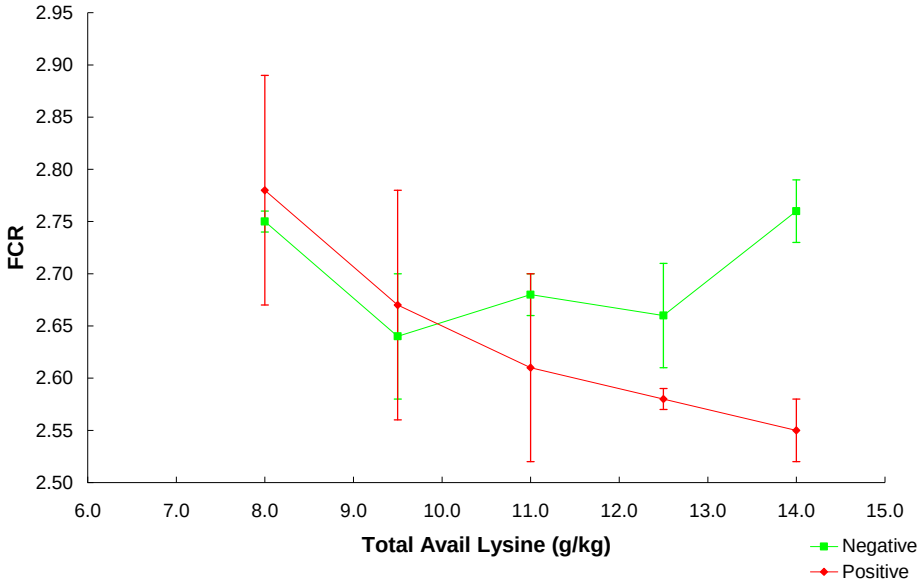

Figure 3. Feed conversion ratio (FCR) ± SE.

Pooled Data

A quadratic model (Figure 4) explained the variation in average daily feed intake with increasing lysine level ($r^2 = 0.85$).

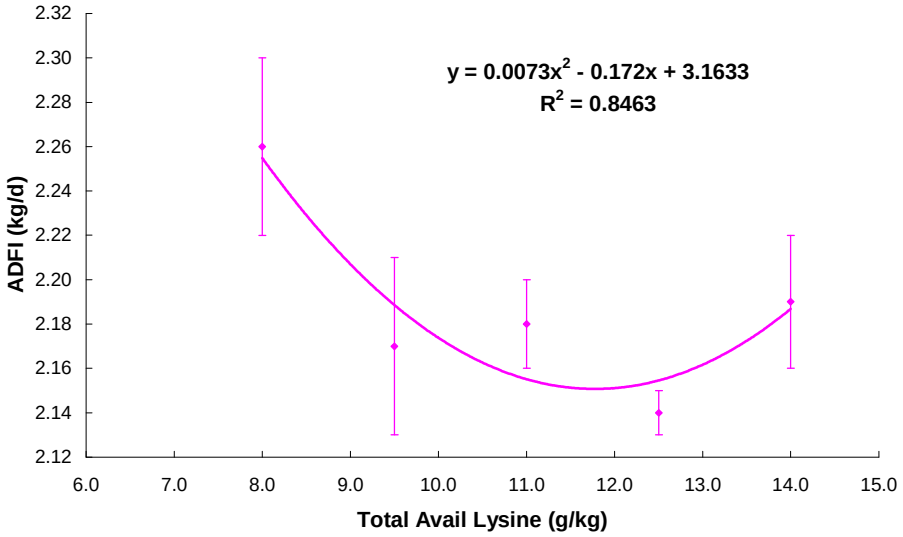

Figure 4. Average daily feed intake (ADFI) ± SE. Pooled data.

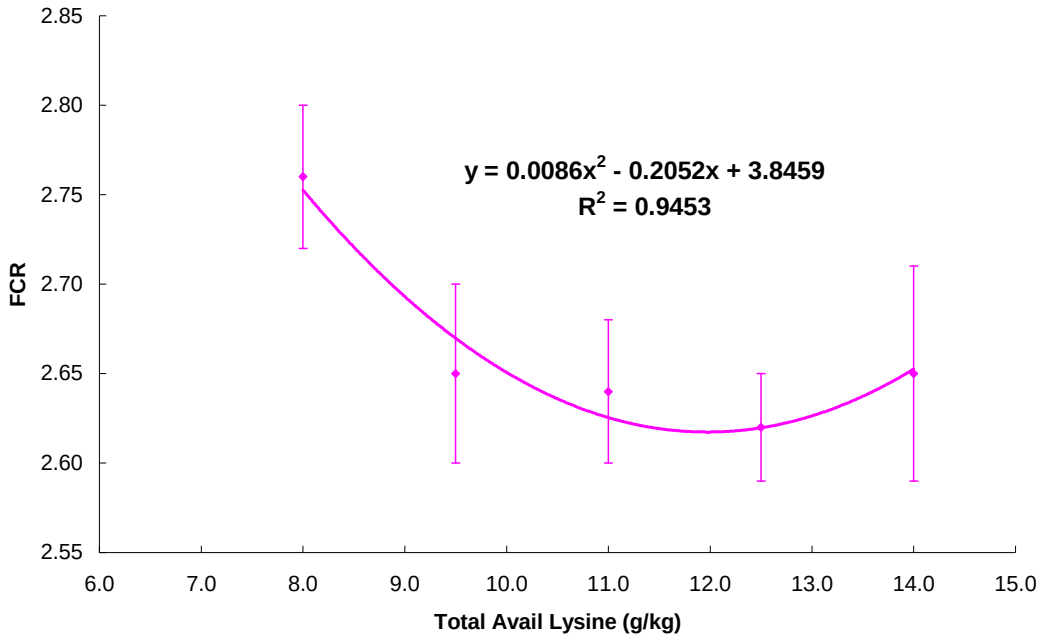

Figure 5. Feed conversion ratio (FCR) ± SE. Pooled data.

The variation in feed conversion ratio with increasing lysine level was also well explained by a quadratic model (Figure 5; $r^2 = 0.95$). However, the explanation of the variation in average daily gain was less well explained (Figure 6). A cubic model ($r^2 = 0.64$) explained the variation better than a quadratic model ($r^2 = 0.48$), however, it appears the feed interruptions on the negative numbered feeders may be influencing this result.

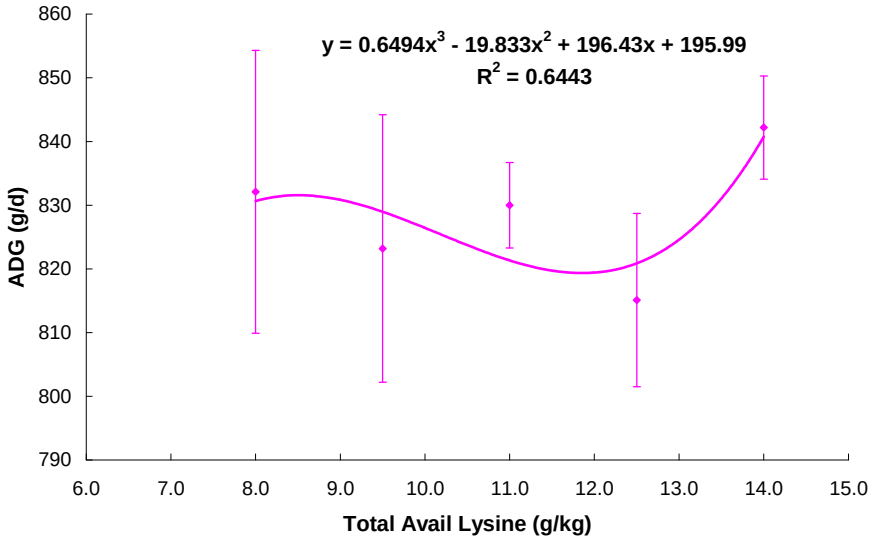

Figure 6. Average daily gain (ADG) ± SE. Pooled data.

Discussion

Feed supply interruptions on the negative numbered feeders in the shed make it difficult to draw conclusions from this experiment. While growth performance and feed conversion of pigs on the positive side of the shed appeared to improve at levels above 11.5 g/kg there is no statistically significant data to support this. It is likely the experiment will need to be repeated if we would like to improve our estimation of optimum lysine requirements for these pigs. The preliminary responses observed here suggest this would be worth pursuing on the basis of improvements in FCR alone.

APPENDIX 1 – DIET FORMULATIONS

```
:                                                                                                                    :
:  Single-Mix Tools     (FM)      MCLEAN FARMS       {14} FEBRUARY 2008            FULL PRINT            15:02 08/02/08  0001 :
: 27-October-2006/643.5r           (   29) Plant=0088      Rob                                                       :
```

Formula basic data

Code	: 10000	Name	: MCLEAN FARMS GROWER 1 FEEDLOGIC 08-02-08		
Sell price:	0.0	Batch [Kg]:	1500.0	Group code:	
Cost :	403.433	Created	: 07/02/08	Version :	
Margin :	-403.34	Updated	: 08/02/08	FM origin	: KPE 60
Tonnes :	0.0	User name	: Rob	VM key :	KPE 60

External reference:
Script file name :

Raw material	%	[Kg]	Tonnes	Cost	Diet cost
13240 SORGHUM 11.0	77.68	1165.2	0.0	340.0	264.112
33160 CANOLA MEAL 38.0	10.0	150.0	0.0	385.0	38.5
40100 BLOOD MEAL 90.0	2.733333	41.0	0.0	815.0	22.277
40660 MEAT MEAL 50.0	5.866667	88.0	0.0	623.0	36.549
45100 TALLOW	2.333333	35.0	0.0	1030.0	24.033
48250 KYNOPHOS 21	0.466667	7.0	0.0	820.0	3.827
49005 SALT (FINE)	0.2	3.0	0.0	267.0	0.534
52810 CHOLINE CHLORIDE 60%	0.046667	0.7	0.0	1526.0	0.712
53000 DL METHIONINE	0.02	0.3	0.0	3926.0	0.785
53150 L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0	1176.0	4.704
PCP4007 CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0	2921.0	7.4
	100.0	1500.0	0.0		403.433

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	0.653199	CHOLINE	MG/KG	:	1007.313333
DRYMATTER	%	:	88.341533	TRYPTOPHAN	%	:	0.176676	FAT/EE	%	:	5.378373
MOISTURE	%	:	11.3958	M+C	%	:	0.606662	W3_FA	%	:	0.101229
PROTEIN	%	:	18.049753	AILYSPIG	%	:	0.799239	W6_FA	%	:	1.051093
NITROGEN	%	:	2.838101	CALCIUM	%	:	0.885036	W3+W6_FA	%	:	1.152323
C_FIBRE	%	:	3.00528	PHOSPHORUS	%	:	0.735872	#AILYS/DEP		:	0.056262
DE_PIG_MJ	MJ/KG	:	14.205627	AV_PHOS	%	:	0.413895	#MET/LYS		:	0.303118
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.202704	#M+C/LYS		:	0.618942
ISOLEUCINE	%	:	0.604555	#CAL/AVPHO		:	2.138312	#TRY/LYS		:	0.180252
LYSINE	%	:	0.98016	SODIUM	%	:	0.158912	#THR/LYS		:	0.666421
METHION	%	:	0.297104	SALT	%	:	0.410216	#ISO/LYS		:	0.616792

Formula basic data

Code : 11000 Name : MCLEAN FARMS GROWER 2 FEEDLOGIC 08-02-08

Sell price:	0.0	Batch [Kg]:	1500.0	Group code:	
Cost :	490.025	Created :	07/02/08	Version :	
Margin :	-489.962	Updated :	08/02/08	FM origin :	KPE 60
Tonnes :	0.0	User name :	Rob	VM key :	KPE 60

External reference:
Script file name :

Raw material	%	[Kg]	Tonnes	Cost	Diet cost
13240 SORGHUM 11.0	57.253333	858.8	0.0	340.0	194.661
33160 CANOLA MEAL 38.0	10.0	150.0	0.0	385.0	38.5
34630 SOYBEAN MEAL 47.5	15.0	225.0	0.0	514.0	77.1
34750 SOYCOMIL R (ADM)	5.6	84.0	0.0	1471.0	82.376
40100 BLOOD MEAL 90.0	3.0	45.0	0.0	815.0	24.45
40660 MEAT MEAL 50.0	6.733333	101.0	0.0	623.0	41.949
45100 TALLOW	1.266667	19.0	0.0	1030.0	13.047
48250 KYNOPHOS 21	0.2	3.0	0.0	820.0	1.64
49005 SALT (FINE)	0.2	3.0	0.0	267.0	0.534
53000 DL METHIONINE	0.093333	1.4	0.0	3926.0	3.664
53150 L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0	1176.0	4.704
PCP4007 CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0	2921.0	7.4
	100.0	1500.0	0.0		490.025

Analysis

[VOLUME]	%	100.0	THREONINE	%	1.038573	CHOLINE	MG/KG	1060.286667
DRYMATTER	%	89.0524	TRYPTOPHAN	%	0.301263	FAT/EE	%	4.102693
MOISTURE	%	10.690267	M+C	%	0.930164	W3_FA	%	0.091784
PROTEIN	%	27.28376	AILYSPIG	%	1.400689	W6_FA	%	0.836013
NITROGEN	%	3.726325	CALCIUM	%	0.998051	W3+W6_FA	%	0.927797
C_FIBRE	%	3.696653	PHOSPHORUS	%	0.801501	#AILYS/DEP		0.098616
DE_PIG_MJ	MJ/KG	14.20344	AV_PHOS	%	0.416525	#MET/LYS		0.298296
ME_PIG_MJ	MJ/KG	0.066	#CAL/PHO		1.245226	#M+C/LYS		0.560879
ISOLEUCINE	%	1.065361	#CAL/AVPHO		2.396134	#TRY/LYS		0.181659
LYSINE	%	1.658403	SODIUM	%	0.163555	#THR/LYS		0.626249
METHION	%	0.494695	SALT	%	0.412104	#ISO/LYS		0.642402