SUMMARY OF FINAL REPORT

PROJECT NUMBER	:	VS 3119/05/1/9.
TITLE	:	Pig nutrition: The "ideal protein" requirements of the growing pig.
RESPONSIBLE OFFICER	:	E H Kemm.
CO-WORKERS	:	F K Siebrits & M N Ras.
RESEARCH INSTITUTION	:	Irene Animal Production Institute.
DURATION	:	1984 to 1992.

The concept of an optimum balance of essential amino acids for growth, which, when supplied with sufficient nitrogen for the synthesis of non-essential amino acids would constitute the 'ideal protein' is now well established. The suggested optimum balance is derived from the pattern of amino acids in body tissues. It has been assumed that the major differences between pigs of different live weight, sex or genotype is in their total protein requirement rather that in different proportions of individual amino acids. Hence, three studies were conducted: (1) To determine amino acid levels in the whole body of both genetically lean and obese pigs (at different live weights) and given diets with three optimally balanced crude protein concentrations. (2) To measure the effect of dietary protein level on rate and pattern of feed intake and growth performance of *ad libitum* fed pigs known to be different in their ability to deposit protein and in their pattern of protein deposition. (3) To measure the effect of dietary protein level on rate and pattern of feed intake and growth performance of *ad libitum* fed pigs of high genetic potential.

Experiment 1 - A note on the effect of dietary protein concentration, sex, type and live weight on whole-body amino acid composition of the growing pig.

Seventy-two Landrace pigs were used to study the effects of dietary crude protein concentration (197, 168 and 137 g/kg air dry meal), sex, type and live weight on the whole-body (gut content included) amino acid composition of growing pigs. Boars and gilts from two types (lean and obese) slaughtered at 20, 30 or 90 kg live weight were used. Mean whole-body amino and concentrations were: lysine 63.4; methionine 21.8; cystine 15.8; threonine 35.1; leucine 67.7; isoleucine 28.0; valine 40.5; phenylalanine 35.5; tyrosine 24.6 and histidine 26.8 g/kg protein. Dietary protein concentration had no effect on body amino acid composition. Boar values tended to be higher than those of gilts but there were no significant differences. Pigs of the obese type also tended to have higher values than lean pigs, with significant differences obtained for methionine, cystine, leucine, and isoleucine. Apart from cystine, live weight had no effect on whole-body amino acid composition. Cystine content however, decreased highly significantly from 17.1 g/kg protein at 30 kg live weight to 14.3 g at 90 kg live weight ($p < 0.001$). When compared with the suggested ideal pattern for essential amino acids leucine and histidine values are higher and isoleucine slightly lower, with no conclusive indication on methionine and cystine.

Experiment 2 - Feed intake, live weight-gain, body composition and protein deposition in pigs fed three protein levels.

A group of 82 genetically lean and 90 obese Landrace pigs was allotted to three dietary treatments with lysine concentrations of 1,22 (T1), 1,02(T2) and 0,83% (T3),

corresponding concentrations of crude protein (CP) of 19,7; 16,8 and 13,7% and digestible energy (DE) concentrations of 14,4; 14,2 and 14.0 MJ/kg diet. Diets were fed *ad libitum* from 8 weeks of age up to slaughter for whole body chemical analyses, at ±20, ±30 or 90 kg live weight. Appropriate regression relationships were used to measure the effect of dietary protein level on the patterns for DE intake, daily gain and the deposition rates of protein (PDR) and fat (FDR) over the growth period 30-90 kg live weight. Dietary CP content had no significant effect on mean voluntary DE intakes and gaily gains DE intakes (MJ/d) for pigs from T1, T2 and T3 were 32,1; 32,2 and 32,8 respectively. Daily gains (g/d) were 737, 728 and 738 and DE: gain ratios were 43,8; 44,6 and 45,0 for the three treatments respectively. Obese pigs consumed highly signicantly more DE than lean pigs (33,4 vs. 31,1 MJ/d), and also needed highly significantly more DE/kg gain (46,0 vs. 42,7 MJ), but they had similar daily gains (733 and 736 g/d). DE intake daily gain, PDR and FDR followed curvilinear patterns. PDR curves peaked at ±56 kg live weight (51 kg for obese gilts and 64 kg for lean boars). Depositon rates increased from a mean of 106 g/d (93 g for obese gilts and 118 g for lean boars) to 124 g (103 g for obese gilts and 143 g for lean boars) at peak deposition, only to decline thereafter to 105 g/d (85 g for obese gilts and 132 g for lean boars) at 90 kg live weight. A reduction of 15% in dietary protein content (T2) had no apparent effect on protein deposition. Pigs from T3, fed 30% less protein than pigs from T1, deposited only 2 g (1,9%) less protein/d at 32 kg live weight, 2 g (1,6%) less at maximum deposition and 2 g (1,9%) less at 90 kg live mass.

Experiment 3 - Feed intake, live weight-gain, body composition and protein deposition in fast growing pigs.

A group of 96 pigs, obtained from a breeder with fast growing pigs, was allotted to three dietary treatments with lysine concentrations of 1,2; 1,2 and 1,3% corresponding concentrations of crude protein (CP) of 18,5; 21,3% and 24,2%, and digestible energy (DE) concentrations of 14,5; 14,5 and 14,6 MJ/kg diet. Diets were fed *ad libitum* from 8 weeks of age up to slaughter for whole body chemical analyses, at ±20, ±30 or ±90 kg live weight. Appropriate regression relationships were used to measure the effect of dietary protein level on the patterns for DE intake, daily gain and the deposition rates of protein (PDR) and fat (FDR) over the growth period 30-90 kg live weight. Dietary CP content had no significant ($p > 0,05$) effect on mean DE intake, DE conversion, weight gain, PDR or FDR when calculated for the growth interval 30-90 kg. Significant ($p < 0,01$) sex effects were however found for all the parameters studied. Boars however gained 862 g/d and gilts only 763, but boars needed less DE/kg gain (36,5 vs. 42,6 MJ).

Boars comsumed 31,4 MJ DE/d and gilts 32,2 MJ, but boars needed appreciably less DE/kg gain (36,5 vs. 42,6 MJ) and consequntly their live weight gain was 13% higher (862 g/d vs. 763) than that of the gilts. As was found in the previous experiment DE intakes, daily gain, PDR and FDR followed curvilinear patterns. PDR curves peaked at 69 kg live weight for boars and 54 kg for gilts. PDR increased from a mean of 126 g/d (128 g for boars and 123 g for gilts) to 154 g/d (166 g for boars and 142 g for gilts) at peak deposition, only to decline thereafter to 135 g/d (159g for boars and 112 g for gilts) at 90 kg live weight. FDR continued to increase throughout the experiment in boar pigs, but reached a peak at 81 kg live weight in the gilts. FDR increased from a mean of 107 g/d (101 g for boars and 114 g for gilts) to 244 g/d (230 g for boars and 258 for gilts) at peak deposition, with no decline in the boars but very a slight decline to 253 g/d in the gilt towards the end of the experiment (90 kg live weight). It can therefore be concluded that an 18,5% protein 14,5 MJ DE diet, when optimally balanced for amino acids, is sufficient to sustain a mean daily gain of ± 850 g/d and a maximum PDR of up to 166 g/d.