

244 Requirement for Digestible Calcium at Different Dietary Concentrations of Digestible Phosphorus Indicated By Growth Performance and Bone Ash of 50 to 85 Kg Pigs. L. V. Lagos*¹, C. L. Walk², H. H. Stein³, ¹University of Illinois, Urbana, IL, ²AB Vista, Marlborough, United Kingdom, ³University of Illinois at Urbana-Champaign, Urbana, IL

An experiment was conducted to determine the requirement for standardized total tract digestible (STTD) Ca by 50 to 85 kg pigs and test the hypothesis that the requirement to maximize growth performance expressed as STTD Ca:STTD P ratio is less than 1.35:1. Fifteen corn-soybean meal based diets were formulated using a 3 × 5 factorial design. Diets contained 0.14, 0.27, or 0.41% STTD P and 0.13, 0.25, 0.38, 0.50, or 0.63% STTD Ca. Ninety barrows (50.21 ± 2.09 kg) were individually housed and randomly allotted to the 15 diets. Diets were fed for 30 d and the amount of feed offered was recorded. At the conclusion of the experiment, pig weights were recorded and ADG, ADFI, and G:F were calculated for each diet. On d 31, pigs were euthanized and the right femur was removed and ash, Ca, and P were determined in dried defatted femurs. Data were analyzed using the response surface model in NLREG by removing the terms in the model that were not significant ($P > 0.10$; Table 1). There was a linear nature of data for growth performance parameters,

Table 1. Estimated models for growth performance and bone mineralization¹

Item	Model	P-value
Growth performance, kg		
ADG	$[0.91-(0.64 \times \text{Ca})+(2.31 \times \text{P})-(4.45 \times \text{P}^2)+(1.75 \times \text{Ca} \times \text{P})]$	<0.001
ADFI	$[3.06-(0.41 \times \text{Ca})]$	0.040
G:F	$[0.39-(0.15 \times \text{Ca})-(0.05 \times \text{P})+(0.54 \times \text{Ca} \times \text{P})]$	<0.001
Bone, g		
Ash	$[18.25+(37.79 \times \text{Ca})-(62.16 \times \text{Ca}^2)+(110.41 \times \text{P})-(234.13 \times \text{P}^2)+(146.24 \times \text{Ca} \times \text{P})]$	<0.001
Ca	$[7.07+(14.63 \times \text{Ca})-(23.85 \times \text{Ca}^2)+(36.99 \times \text{P})-(79.79 \times \text{P}^2)+(56.01 \times \text{Ca} \times \text{P})]$	<0.001
P	$[3.34+(6.26 \times \text{Ca})-(11.48 \times \text{Ca}^2)+(18.49 \times \text{P})-(39.81 \times \text{P}^2)+(27.41 \times \text{Ca} \times \text{P})]$	<0.001
Bone, %		
Ash	$[56.26-(4.97 \times \text{Ca})-(7.64 \times \text{P})+(42.29 \times \text{Ca} \times \text{P})]$	<0.001
Ca	$[36.95+(0.95 \times \text{Ca})]$	0.014
P	$[17.79-(1.73 \times \text{Ca})-(0.30 \times \text{P})+(3.69 \times \text{Ca} \times \text{P})]$	<0.001

¹Full model= $[a+(b \times \text{Ca})+(c \times \text{Ca}^2)+(d \times \text{P})+(e \times \text{P}^2)+(f \times \text{Ca} \times \text{P})]$.

which prevented prediction of maximum responses, but allowed for analysis of optimal STTD Ca:STTD P ratios. For concentrations of STTD P below, at, or above the requirement, the ideal ratio between STTD Ca and STTD P is less than 1:1, 1.25:1, and greater than 1.5:1, respectively, which indicates that the dietary STTD Ca:STTD P ratio depends on the quantity of STTD P in the diet. Predicted maximum bone ash (g) at STTD P concentrations of 0.14, 0.27, and 0.41% were 42.7, 55.9, and 64.0 g. These values were obtained at STTD Ca:STTD P ratios of 3.35:1, 2.30:1, and 1.92:1. In conclusion, excess Ca is detrimental to growth if the concentration of P is at or below the requirement. The STTD Ca needed to maximize bone ash is greater than that needed to maximize growth performance and the STTD Ca:STTD P ratio needed to assure sufficient bone mineralization without affecting growth performance is less than 1.35:1 if the concentration of P is at the requirement.

Key Words: digestible calcium, pigs, requirements
