

ENVIRONMENT

Title: Estimation of the mass balance of nutrients for specific production phases and the flow of nutrients through a swine farm - **NPB #05-130**

Investigator: Scott Carter

Institution: Oklahoma State University

Co-Investigator: Doug Hamilton

Date Submitted: 5/23/07

Abstract

Three experiments were conducted. In Experiment 1, seventy-six crossbred pigs (28 kg body weight) were used to evaluate the effects of reducing dietary crude protein (CP), phosphorus (P), and trace minerals (TM) on dry matter (DM), nitrogen (N), P, and mineral excretion and on ammonia and hydrogen sulfide emissions during a 110-d finishing period. Pigs were blocked by body weight and randomly allotted to dietary treatments. Pigs were housed in an environmentally-controlled building with 4 identical rooms, each room having a shallow pit, pull plug system (19 pigs/room, 2 rooms/treatment). The control diet was a fortified corn-soybean meal diet with 0.1% inclusion of TM premix for Phases 1, 2, 3 and 4. Diet 2, which was a low nutrient excretion (LNE) diet, was similar to the control with the exceptions that CP was reduced by 3% units, P by 0.1% units, phytase added (500 FYT/kg), and TM premix reduced by 50, 77, 83 and 100% for Phases 1 - 4, respectively. Diets were formulated on true digestible lysine basis, and methionine, threonine and tryptophan were added to LNE on an ideal basis as needed. Pig weight, feed intake, pit volume, and slurry pH were measured weekly. Feed and slurry samples were collected weekly for DM, N, P, and mineral analyses. Slurry pH and electroconductivity tended to be reduced for pigs fed the LNE diet. Slurry from pigs fed the LNE diet had lower concentrations of DM, N, P, carbon, ammonium nitrogen, calcium, potassium, sulfur, iron, zinc, copper, and manganese. Daily N and P excretion was reduced in each phase for pigs fed the LNE diet and this reduction led to a 30 and 34% reduction for the entire finishing phase. Macro-mineral excretion was reduced on average of 23% and for the micro-minerals, excretion was reduced by 46% for pigs fed the LNE diet. The cumulative excretion of DM, N, and P for the entire finishing period was reduced by 3.7, 1.1, and 0.23 kg/pig, respectively, for pigs fed the LNE diet. The concentration (mg/m^3) and emission rate (mg/min) of ammonia in the exhaust air was reduced by 52% for pigs fed the LNE diet. The decrease in emission rate for pigs fed the LNE diet resulted in a 59% decrease in ammonia emitted per pig per day. However, the concentration, emission rate, and emission per pig for hydrogen sulfide were not affected by dietary treatment. Diet did not affect growth performance, carcass traits, or whole body composition and accretion, or feed costs per pig. From these data, mass balance of nutrients for the finishing phase was calculated. Based on mass balance, it was calculated that for pigs fed the LNE diet that 58% of the nitrogen entering the room exited the room via the pigs versus 47% for pigs fed the control diet. Likewise, the amount of P exiting the room via the pigs as a percentage of that entering room increased from 37% for pigs fed the control diet to 48% for pigs fed the LNE diet. These results suggest a marked reduction in nutrient excretion and ammonia emission for pigs fed LNE during the finishing period.

These research results were submitted in fulfillment of checkoff funded research projects. This report is published directly as submitted by the project's principal investigator. This report has not been peer reviewed

For more information contact:

National Pork Board, P.O. Box 9114, Des Moines, Iowa USA

800-456-7675, **Fax:** 515-223-2646, **E-Mail:** porkboard@porkboard.org, **Web:** <http://www.porkboard.org/>

In another series of experiments, nutrient excretion for pigs during the nursery phase was determined (Experiment 2) and the effect of waste treatment on the concentration of nutrients in the waste stream was determined (Experiment 3). Nutrient excretion increased with each progressive nursery phase with the greatest differences in excretion observed for zinc and copper. The cumulative excretion for DM, N, and P equaled 7.32 kg, 0.424 kg, and 41.9g per pig during the 43-d nursery phase. The waste treatment system used on this farm decreased the nutrients measured by greater than 77% with a 90, 93, and 91% reduction in total nitrogen, ammonium-nitrogen, and phosphorus concentration from the effluent leaving the barns to the 2nd stage aerobic lagoon.