

ENVIRONMENT

Title: Feeding amino acids to reduce air emissions and the carbon footprint of swine production –
NPB #12-119

Investigator: Wendy Powers

Co-investigators: Nathalie Trottier, Qian-feng Liu

Institution: Michigan State University

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Scientific abstract

A study was conducted to investigate the feed-through-field impacts of feeding a reduced crude protein diet to grow-finish pigs. Seventy-two pigs in 12 experimental rooms (6 pigs/room) were fed standard (18.5% to 12.2% CP over the grow-finish period, 6 rooms) or reduced CP diets (17.5% to 11.0% CP over the grow-finish period, 6 rooms) over the course of 5 feeding phases (107 d, total). Diets contained similar energy and lysine contents within each feeding phase. During the animal growth period, animal performance and air emissions were monitored. Manure collected during the 107-d feeding period was pooled by diet, across phases, and moved to incubate in storage containers equipped with stirrers. Air flowed across the manure surface continually for a 90-2 storage period (1.2 L/min) and headspace air was measured. Stored manure was then land applied to a soil surface in 208 L barrels at an application rate equivalent to 180 lb N/acre (570 g manure applied) and emissions measured for 7 d with continuous airflow across the soil surface (1.2 L/min). Results showed that diet did not alter average daily gain (ADG; 1.013 kg/d-pig), average daily feed intake (ADFI; 2.714 kg/d-pig), or feed conversion ratio (FCR; 2.735 kg feed/kg gain) ($P > 0.05$). Dietary treatments had no effect on manure excretion rate or total solids concentration across feeding phases ($P > 0.05$). The manure concentrations of N and $\text{NH}_4^+\text{-N}$ when removed from housing did not differ among pigs fed the different diets across phases. Dietary treatments and phases had significant effects on NH_3 emissions ($P < 0.05$). Feeding the reduced CP diet resulted in lower NH_3 concentrations (ppm) and emissions (mg/d) (1471 vs. 2174 mg over the 107-d feeding period; $P < 0.05$). The percent NH_3 emission reduction observed for each percentage unit reduction in diet CP content was 47.9%, 53.2%, 26.8%, 26.5% and 51.6% during phases 1 through 5, respectively. As a result of the 90-d storage period, average daily ammonia emissions from barrels containing manure from pigs fed the standard CP diets were double that from barrels containing the reduced CP diet manure (0.51 g/d vs. 0.24 g/d; $P < 0.01$). No other gases were different. Average daily emissions over the 7-d period that followed land application of the stored manures demonstrated no treatment differences for any gases. Using a feed-through-field approach for considering nutrient losses is that we demonstrated that over 40% more N is lost in the form of ammonia emissions during housing and manure storage as a result of feeding the standard CP diet. However, diet strategies that produce large differences in ammonia emissions do not necessarily result in observed differences in nitrous oxide emissions.

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For more information contact:

National Pork Board • PO Box 9114 • Des Moines, IA 50306 USA • 800-456-7675 • Fax: 515-223-2646 • pork.org
