RESEARCH ABSTRACT

ENVIRONMENT

Title: Effects of inclusion of corn distillers dried grains with solubles in the diet of finishing pigs and gestating sows on nutrient excretion and gaseous emissions – **NPB** #09-124

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Scientific Abstract

A total of 80 crossbred pigs was used to determine the effects of increasing DDGS on nutrient excretion during the finishing phase (37 to 135 kg). Pigs were housed in an environmentally-controlled building with four identical rooms (20 pigs/room), each with a shallow pit, pull-plug system. Pigs were stratified by BW, sex, and ancestry, and randomly assigned to one of four rooms. Diets were randomly allotted in 4 x 4 Latin square design with four rooms and four dietary phases. The four dietary treatments included fortified corn-soybean meal based diets containing 0, 10, 20 or 40% DDGS which replaced corn, soybean meal, and dicalcium phosphate. Crystalline Lys was used to limit the increase in dietary CP for diets containing DDGS and Trp was added as needed to maintain ratios in all phases. All diets, within the four dietary phases, were balanced on SID Lys and digestible P. Each phase consisted of a 1-wk adjustment period followed by a 3-wk slurry collection period. Inclusion of 10 or 20% DDGS had little effect on ADG or G:F, but 40% DDGS reduced performance (quad, $P < 0.05$). However, DDGS did not affect ADFI. Slurry pH decreased (linear, $P < 0.01$) and volume increased ($P = 0.02$) as DDGS increased. The daily intakes of N ($P < 0.09$), Mg and S ($P < 0.01$) were increased linearly with increasing DDGS. However, P intake decreased (linear; $P < 0.07$), but DDGS did not affect DM and Ca intakes. Excretion (g/d) of DM, N, Mg, and S were increased (linear; $P < 0.01$) by 165, 145, 159, and 279% for pigs fed 40% DDGS. Increasing DDGS slightly increased (linear, $P = 0.10$) P excretion, but did not affect Ca and K excretion. The emissions of NH_3, H_2S, CH_4, and N_2O were dramatically increased ($P < 0.01$) for pigs fed increasing DDGS.

In Exp. 2, a total of 80 crossbred pigs was used to determine the effects of DDGS on nutrient excretion during the entire finishing phase (39 to 125 kg). Pigs were housed in the same building used for Exp. 1. Pigs were stratified by BW, sex, and ancestry, and randomly assigned to one of four rooms. Pigs were stratified by sex, weight, ancestry and randomly allotted to 1 of 2 dietary treatments. Dietary treatments were fed in 4 dietary phases and consisted of a fortified corn-soybean meal diet and a control diet with 25% DDGS. Lysine HCl was used in the DDGS diet to maintain similar CP concentration as the control, and Thr and Trp were added as needed to maintain AA ratios. Digestible P was decreased by phase for pigs fed the control diet, but in the DDGS diet, digestible P was unable to be decreased due to the contribution from DDGS. All diets within phase were formulated on a SID Lys basis. Feed and slurry samples were collected weekly along with pig

weights, feed intake, pit volume, and pH of slurry. Addition of DDGS slightly decreased ($P < 0.05$) ADG, but had no effect ($P > 0.10$) on ADFI or G:F. Intakes of DM and N were not affected ($P > 0.01$) but S intake increased ($P < 0.01$) for pigs fed DDGS. Slurry volume was numerically increased, while slurry pH decreased ($P < 0.02$) with DDGS. The daily excretion of DM and S were increased by approximately 38% for pigs fed DDGS. However, N excretion was not affected ($P > 0.10$) by feeding DDGS with the amino acid supplementation strategy used. The emission of H_2S and CH_4 were increased ($P < 0.06$), but no effect on NH_3 or N_2O emissions were observed for pigs fed DDGS. These results suggest that DM (CH4) and S (H_2S) excretion increase with DDGS inclusion in the diet, but N (NH_3) excretion can be limited with dietary formulation.

In Exp. 3, a total of 88 sows (212 kg; parity = 2.5) were used to determine the effects of distillers dried grains with solubles (DDGS) on nutrient excretion during the gestation period. Sows were stratified by BW, parity, and status of gestation, and housed in one of two identical environmentally-controlled buildings (experimental unit) with shallow pit, pull-plug systems. Dietary treatments were randomly assigned to one of two buildings in a 2 (trt) x 2 (building) crossover design. The control diet consisted of a fortified corn-soybean meal based diet formulated to 12% CP, 0.47% SID Lys and 0.39% digestible P. The experimental diet (DG40) contained 40% DDGS and was formulated to 16% CP, 0.47% SID Lys and 0.39% digestible P. DDGS replaced corn, soybean meal and dicalcium phosphate and Lys HCl was used to adjust dietary levels of CP and SID Lys. Each of two phases consisted of a 6-wk period which included a 2-wk adjustment period followed by a 4-wk slurry collection period. At the end of the initial 6-wk period, treatments were switched between buildings to allow for another 6-wk period. There was no difference ($P > 0.10$) in feed intake (2.28 vs. 2.20 kg) for sows fed control vs. DG40. Also, slurry pH (7.66 vs. 7.65), temperature (16.6 vs. 17.2 °C), and volume (38.4 vs. 42.7 L) were similar ($P > 0.10$). Daily intakes of DM, P, Ca, K, Fe, Zn, Cu, and Mn were similar ($P > 0.10$) for both dietary treatments. However, daily N intake tended to increase ($P = 0.10$), but Mg, Na, and S intake increased ($P < 0.05$) for sows fed 40% DDGS. Inclusion of DDGS in the diet increased ($P = 0.04$) daily excretion of DM and S by 28 and 68%, respectively. The daily excretion of Ca and Mg tended to increase ($P < 0.08$) with DDGS. Daily N excretion increased by 20% with inclusion of DDGS in the diet; however, this was not significant ($P = 0.12$). The concentrations of NH_3, H_2S, and CH_4 in exhaust air were increased ($P < 0.07$) for sows fed DDGS. In conclusion, 40% inclusion of DDGS in the diet of gestating sows markedly increases DM and S excretion and NH_3, H_2S, and CH_4 concentrations.

These results suggest that addition of DDGS to corn-soybean meal diets increases DM and S excretion. These increases in excretion resulted in marked increases in CH_4 and H_2S concentration or emissions for swine fed DDGS. The daily excretion of N andNH_3 emission can be controlled for pigs fed DDGS using dietary strategies that limit the increase in dietary CP with DDGS inclusion. Based on these results, methods to increase DM digestibility (reducing DM excretion) and reduce S content of DDGS warrant further investigation to limit the environmental implications associated with feeding DDGS.