

having rancid, bloody, and bitter flavor notes. Non-fed cow meat more frequently had bloody and fatty off-flavor notes than meat from fed cows ($P=.03$ and $.07$, respectively). It appears that bitter blockers do not deteriorate sample flavor. However, samples that possess a greater

amount of initial off-flavor are needed to truly evaluate the mitigation properties for bitter blockers.

Key Words: Off-flavor, Bitter blocker, Cow beef

Nonruminant Nutrition

250 Comparative efficacy of commercial dry mold inhibitors as determined by carbon dioxide evolution. M. Burke*, T. Truong, A. Lamptey, S. Moore, and V. Sewalt, *Kemin, Des Moines, IA*.

Mold inhibitors ensure the nutritional quality of feeds. The efficacy of five commercial dry mold inhibitors was established in two experiments. Products included dry calcium propionate (CaP) and four products made with organic acids on a dry carrier (AOC), coded based on total acid content: AOC48, AOC42, AOC34 and AOC23, containing 48, 42, 34, and 23% total acids, respectively. In Experiment 1, AOC42 was compared with AOC23. In Experiment 2, AOC48, AOC42, AOC34 and CaP were compared. In each experiment mash swine feed was treated in triplicate with 1 and 2 kg/MT of each product. Treatments were arranged as 2x2 (Exp. 1) or 4x2 (Exp.2) factorials with 2 or 4 products and 2 application rates. Untreated controls were also evaluated in triplicate. Samples were held at 25°C and product efficacy was established by monitoring CO₂ evolution and calculating the days-to-midpoint CO₂ (approx. 10%) using polynomial regression. Product characteristics such as concentration of organic acid, propionic acid, pH, degree of buffering and the concentration of free (undissociated) acid were determined. In Experiment 1, AOC42 was more effective ($P<0.001$) in delaying days-to-midpoint CO₂ (11.1 d) than AOC23 (8.3 d). The magnitude of the difference in efficacy between the two application rates was also larger ($P<0.001$) for AOC42 (9.2 vs 12.9 d) than for AOC23 (7.5 vs 9.1 d) (product x application rate interaction. In Experiment 2, each AOC product showed significantly slower ($P<0.05$) CO₂ evolution (9.8 to 12.4 d to reach midpoint) than CaP (8.4 d). Strong positive correlations existed between efficacy and concentrations of free (undissociated) and total acid. Negative correlations were found between pH and percent free acid and between pH and efficacy. Overall, the AOC products outperformed CaP as determined by reduced CO₂ evolution. Although the most effective AOC product was also the most corrosive, the correlation between efficacy and corrosiveness was low, allowing for product selection targeting effective mold control with minimal risk of metal corrosion.

Key Words: Mold inhibition, Propionic acid, Calcium propionate

251 The effects of dietary glutamine, glycine, and salt concentration on nursery pig growth performance. C. N. Groesbeck*, M. D. Tokach, S. S. Dritz, J. M. DeRouchey, J. L. Nelssen, and R. D. Goodband, *Kansas State University, Manhattan*.

A total of 216 pigs (5.6 kg BW, 21 ± 2 d of age) were used in a 14-d growth assay to evaluate the effects of feeding added salt (0.38% in addition to the 0.35% already in the diet) or a 0.70% addition of a 50% glutamine:50% glycine (Glu/Gly) blend as a substitute for spray-dried animal plasma (SDAP). Pigs were blocked by weight and randomly allotted to one of six dietary treatments. Diets included a corn-soybean

meal-based negative control, a positive control containing 5% SDAP, and high crystalline amino acid diets arranged in a 2 x 2 factorial with main effects of Glu/Gly (none or 0.70%) and added salt (none or 0.38). The crystalline amino acids replaced the essential amino acids provided by SDAP. From d 0 to 7, ADG and ADFI were greater ($P<0.05$) for pigs fed the positive control diet compared with all other treatments. Pigs fed the high crystalline amino acid diets with or without added Glu/Gly and salt had improved ($P<0.05$) G:F compared with pigs fed the negative and positive control diets. From d 7 to 14, pigs fed the positive control diet had greater ($P<0.05$) ADG compared with pigs fed the negative control; however, it did not differ from pigs fed the four added Glu/Gly or salt treatments. Pigs fed the positive control diet had greater ($P<0.05$) ADFI and G:F compared with all other treatments. From d 0 to 14, pigs fed the positive control diet had greater ($P<0.05$) ADG and ADFI compared with pigs fed the negative control diet and greater ($P<0.05$) ADFI compared with all other treatments. Adding SDAP to the diet improved growth performance of nursery pigs, while adding salt above the 0.35% already provided in the diet and adding Glu/Gly to the synthetic amino acid diets did not influence growth performance. However, pigs fed diets containing high levels of synthetic amino acids had intermediate ADG and improved G:F to SDAP and negative control.

Key Words: Glutamine, Glycine, Sodium

252 Immunomodulatory effects of a *Bacillus*-based direct-fed microbial and antibiotics on the cytokine profile of nursery pigs.

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A total of 288 pigs were weaned to a wean-to-finish facility and blocked by BW to determine the effect of a *Bacillus*-based direct-fed microbial (DFM) and antibiotic supplementation on the cytokine profile of blood monocytes and lymphocytes. Dietary treatments were arranged as a 2 x 2 factorial with two levels of antibiotic (0 and 50 g carbadox/ton of feed during Phase 1 and 2, and 0 and 400 g oxytetracycline/ton of feed during Phase 3) and two levels of DFM (0 and 0.25%). Peripheral blood mononuclear cells (PBMC) were isolated from 4 pigs/treatment on d 20 and d 42 after weaning and cytokine production was elaborated by stimulating with lipopolysaccharide (LPS) for production of tumor necrosis factor- α (TNF) and IL-1 and with concanavalin A for production of IL-4. An additional plasma sample was obtained to measure circulating concentrations of TNF. Production of IL-1 from PBMC isolated from pigs fed DFM decreased ($P<0.05$) from d 20 to d 42 post-weaning, whereas production of IL-1 by pigs not provided DFM was similar across the two days (DFM x day, $P<0.05$). Conversely, production of IL-4 by PBMC from pigs fed DFM did not change from d 20 to d 42 post-weaning, whereas IL-4 production by PBMC from unsupplemented pigs decreased ($P=0.05$) from d 20 to d 42 (DFM x day, $P<0.05$).