

in a coarse grind configuration (4-high coarse). In Exp. 2, 90 pigs (PIC 327 × 200; initial BW = 12.2 kg) were randomly allotted to 1 of 3 diet comparisons to determine feed preference. The 3 diets compared were the 2-high, 4-high fine, and 4-high coarse configurations. Each pen contained 2 feeders, each containing 1 of the 3 treatment diets. Feeders were rotated once daily within each pen for the 7-d study, with 5 pigs per pen, and 6 pens per comparison. In Exp. 1, there were no differences in ADG, ADFI or G:F between roller mill configurations. Similarly, no differences were observed for caloric efficiency or economics among roller mill configurations. In Exp. 2, when given a choice, pigs consumed 67% ( $P < 0.05$ ) of the diet containing corn ground through the 2-high roller mill when compared to the diet containing 4-high fine corn. There was no difference in feed consumption comparing diets with 2-high roller mill corn or corn from the 4-high roller mill in a coarse configuration. When comparing corn from the two 4-high configurations, pigs consumed 63% ( $P < 0.05$ ) of the diet manufactured in the coarse configuration and 37% when manufactured in the fine grind configuration. When given a choice, pigs preferred diets manufactured using a mill configuration producing coarser ground corn (490 to 650  $\mu\text{m}$ ) to fine ground corn (340  $\mu\text{m}$ ); however, roller mill configuration did not affect performance.

**Key Words:** roller mill, nursery pigs, feed preference  
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#### 216 Coating dog kibble with a commercial liquid acidifier reduces the risk of *Salmonella* cross-contamination.

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In recent years, several pet food recalls have been attributed to *Salmonella* contamination. In addition to the negative impacts on animal health, pet foods contaminated with *Salmonella* have been linked to infection in humans. To help reduce the risks to humans, the Food and Drug Administration has set forth a zero-tolerance policy for *Salmonella* in pet foods. Typically, the preconditioner and extruder operate at sufficient temperatures to destroy pathogenic bacteria. However, there is the potential for post-processing cross-contamination to adulterate the product. One potential method to reduce the risk of *Salmonella* cross-contamination in pet foods is through the addition of chemical additive coatings. The objective of this research was to evaluate the ability of the liquid acid,  $\beta$ -hydroxy- $\beta$ -methylbutyric acid (HMB; Metabolic Technologies Inc, Ames, IA), to reduce cross-contamination of dry extruded dog kibble with *Salmonella*. Liquid HMB was applied to a single formula of dog kibble at inclusion levels of 0, 0.9 and 1.5% (w:w) using a laboratory-scale mixer. The coated kibbles were then inoculated with *Salmonella enterica* subsp. *enterica* Serovar Enteritidis (ATCC 13076), grown in trypticase soy broth (TSB). Inoculated kibbles were enumerated

for *Salmonella* on d 0, 1, 2, 7, and 14 post-inoculation. For enumerations, a subsample was collected, serially diluted and spread plated to Xylose Lysine Deoxycholate (XLD) agar. All inoculated plates were incubated at 37°C for 24 h, after which black colonies, typical for *Salmonella*, were counted and cfu/g calculated. The effects of HMB concentration, enumeration day and their interaction were all significant ( $P < 0.0001$ ) on the resulting *Salmonella* concentration. *Salmonella* counts from Day 0 were 6.99, 5.59, and 4.88 log<sub>10</sub> cfu/g for 0, 0.9 and 1.5% HMB, respectively. For HMB levels of 0.9 and 1.5%, counts were below the detectable limit for d 1, 2, 7, and 14. For 0% HMB, the *Salmonella* counts were found to decrease over time to 4.80, 3.99, 2.80, and 3.14 log<sub>10</sub> cfu/g for d 1, 2, 7, and 14, respectively. Overall, the HMB coating was effective at reducing *Salmonella* artificially inoculated to dog kibbles. Further research is warranted to evaluate the minimum effective dose of HMB to reduce *Salmonella* in dog and cat kibbles.

**Key Words:** Salmonella, cross-contamination, pet food  
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#### 217 Proof-of-concept method to sanitize a feed mill contaminated with Porcine Epidemic Diarrhea Virus.

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Porcine Epidemic Diarrhea Virus (PEDV) has been linked to transmission by livestock feed or ingredients. Measures to exclude pathogens, prevent cross-contamination, and actively reduce the pathogenic load of feed and ingredients are being developed. However, research thus far has focused on the role of chemicals or thermal treatment to reduce PEDV RNA in feedstuffs, and has not addressed potential residual contamination within the manufacturing facility that may lead to continuous cross-contamination of finished feeds. The objective of this experiment was to evaluate the use of a standardized protocol to sanitize an animal feed manufacturing facility contaminated with PEDV. Environmental swabs were collected throughout the facility during the manufacturing of a swine diet inoculated with PEDV. To monitor facility contamination of the virus, swabs were collected at 5 decontamination steps: 1) baseline before inoculation, 2) after production of the inoculated feed, 3) after application of a quaternary ammonium-glutaraldehyde blend cleaner, 4) after application of a sodium hypochlorite sanitizing solution, and 5) after facility heat-up to 60°C for 48 h. The feed mill was contaminated and decontaminated 3 separate times for a total of 3 replications. Collected swabs were analyzed via RT-qPCR and categorized by surface (plastic, rubber, concrete, and metal), type (equipment and structural), and zone (1, 2, and 3). Decontamination step, surface, type, zone and their interactions were all found to impact the quantity of detectable PEDV RNA ( $P < 0.05$ ). As expected, all samples collected from direct feed contact

surfaces (zone 1) contained PEDV RNA after production of the contaminated feed. Additionally, all swabs collected directly adjacent to direct feed contact surfaces (zone 2) were positive following production of the contaminated feed. Of the remaining swabs collected (zone 3), outside of zones 1 and 2, 88.9% had detectable RNA, emphasizing the potential role dust plays in cross-contamination of pathogens throughout a manufacturing facility. Application of the cleaner, sanitizer, and heat were effective at reducing PEDV RNA ( $P < 0.05$ ), but did not completely eliminate it. Specifically, 29.6%, 14.8%, and 7.4% of zone 1 swabs had detectable PEDV RNA after decontamination with the cleaner, sanitizer and heat, respectively, during only replication 2. Due to this, decontamination was repeated with no PEDV RNA detected from subsequent swab collection. These findings do provide a method for facility decontamination of PEDV, however, the use of liquid cleaners, sanitizers, and/or facility heat-up may not be applicable for most commercial feed manufacturing facilities.

**Key Words:** PEDV, disinfection, feed mill

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### 218 Characterization of variability in the U.S. pork supply.

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Improving consistency in the U.S. pork supply has long been a goal of producers and processors, though factors contributing to variability in pork composition and quality are ill-defined. Therefore, variability in pork quality and composition and correlations among compositional and quality traits were characterized in multiple studies. In boneless loins destined for export to a quality focused market ( $N = 154$ ), subjective color and marbling scores at 1 and 28 d postmortem were not correlated with sensory tenderness ( $P \geq 0.47$ ), chewiness ( $P \geq 0.18$ ), juiciness ( $P \geq 0.43$ ), or off-flavor ( $P \geq 0.07$ ). In-plant loin firmness measures did not account for variability in sensory characteristics ( $P \geq 0.08$ ). In a larger study, 7864 pigs were used to quantify variability in carcass traits attributable to marketing group (MG), sex, season (hot or cold), and production focus (lean growth or superior meat quality). The Levene's test was used to determine differences in variability among MG, sex, season, and production focus. The mivque0 option of PROC VARCOMP was used to evaluate the proportion of variability each effect contributed to total variance. Marketing group contributed 4.1% and sex contributed 1.4% of the variation of HCW. Variation in fat depth was attributed to production focus (26.7%), sex (17.6%), and season (4.5%). Variation in loin depth was attributed to production focus (20.0%), season (16.1%), MG (2.0%), and sex (1.4%). Production focus (34.6%), sex (15.8%), and season (10.2%) were large contributors to total variation in percent lean. However, the random effect of pig contributed the greatest proportion

of total variance to carcass traits (93.5% of HCW, 51.2% of fat depth, 60.5% of loin depth, and 39.4% of percent lean). Barrows had greater variability than gilts for fat depth and percent lean ( $P \leq 0.01$ ), but variability between sexes was not different for HCW and loin depth ( $P \geq 0.09$ ). Variability was greater in the hot season for HCW, but was less for fat depth and percent lean compared with variability of pigs from the cold season ( $P \leq 0.01$ ); loin depth was not different ( $P = 0.23$ ). Variability was greater in pigs from the quality production focus than the lean focus for HCW, fat depth, and loin depth ( $P \leq 0.03$ ). Variability was different among MG for HCW, fat depth, and percent lean ( $P \leq 0.01$ ) but not loin depth ( $P = 0.20$ ). While segregating pigs by MG or production focus may limit variability in carcass composition, a larger amount of variability is attributed to sex, season, and pig, which are more difficult to control.

**Key Words:** pork composition, quality, variability

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### 219 Requirements for digestible Ca by growing pigs.

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Nine experiments were conducted toward developing a system for determining digestible Ca requirements in growing pigs. In Exp. 1, it was demonstrated that there is a considerable loss of absorbed Ca in the intestinal tract, which indicates that values for digestible Ca need to be based on standardized digestibility. Experiment 2 was conducted to determine where in the intestinal tract Ca is absorbed and results indicated that Ca is absorbed in the small intestine and no absorption of Ca takes place in the large intestine. No differences were observed between ileal and total tract digestibility values, therefore, total tract collections can be used to determine digestibility of Ca. Experiments 3, 4, and 5 were conducted to establish standard total tract digestibility (STTD) values of Ca in a number of feed ingredients without and with microbial phytase. Results indicated that microbial phytase increases STTD of Ca in calcium carbonate and fish meal, but not in dicalcium phosphate and monocalcium phosphate. Experiments 6 and 7 were conducted to determine the STTD Ca requirements by 11 to 25 kg pigs. Six diets were formulated to contain 0.32, 0.40, 0.48, 0.56, 0.64, or 0.72% STTD Ca and 0.36% STTD P. Results indicated that the concentration of STTD Ca in the diets needed to maximize bone ash was 1.33 times the concentration of STTD P. Experiments 8 and 9 were conducted to determine the requirement for STTD Ca and STTD P by 25 to 50 kg pigs. A total of 20 diets were formulated to contain 0.13, 0.27, 0.42, 0.57, or 0.72% STTD Ca and 0.15, 0.31, 0.39, or 0.47% STTD P. Results indicated that the concentration of dietary STTD Ca needed to maximize growth performance was between 1.06 and 1.43 times the concentration of STTD P, but to maximize