

pooled and included in each ELISA. No difference of antibody response was found between horses from the 3 dietary groups, with the exception of an elevated antibody response to BVDV in horses fed TD1 and 2 compared to the control group on d 21 post-vaccination ($P < 0.05$). Therefore, IgGb, IgGt, IgGa, and IgM isotypes were tested individually from the d 21 BVDV sample. No differences were observed between the groups for individual isotypes, although there was a trend for enhanced antibody response in horses fed test diets. The test diets may support elevated antibody response in the horse.

Key Words: equine, antibody, immune, diet, vaccine response

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408 Determining the standardized ileal digestible lysine requirement of 6.8 to 15.9 kg pigs.

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A total of 300 maternal line barrows (DNA; 200 × 400, initially 6.75 ± 0.23 kg BW) were used in a 21d trial to determine the standardized ileal digestible (SID) Lys requirement of nursery pigs from 6.8 to 15.9 kg. Pigs were randomly allotted to pens at weaning based on BW and were fed a common diet for 9 d after weaning. There were 10 replicate pens/treatment and 5 pigs/pen. Pens of pigs were allotted to experimental diets based on average BW, in a completely randomized design. The 6 dietary treatments consisted of 1.05, 1.15, 1.25, 1.35, 1.45, and 1.55% SID Lys and were achieved by increasing the inclusion of crystalline amino acids, allowing soybean-meal to stay constant across dietary treatments. Experimental data was analyzed using general linear and nonlinear mixed models with heterogeneous residual variances and pen as the experimental unit. Competing models included linear (LM), quadratic polynomial (QP), broken-line linear (BLL), and broken-line quadratic (BLQ). The best-fitting model for each response was selected using Bayesian information criterion (BIC). Increasing SID Lys linearly improved ($P = 0.001$) G:F. There was a marginal quadratic response for ADG ($P = 0.067$) with increasing SID Lys. The ADFI increased in a quadratic manner ($P = 0.019$) from 1.05 to 1.25% SID Lys. For ADG, the best-fitting comparable models were BLL [predicted equation: 462– 271 × (1.29– Lys), if SID Lys < 1.29%] and BLQ [predicted equation: 465– 372 × (1.47– Lys)², if SID Lys < 1.47%], estimating the requirement at 1.29% (95% CI: [1.23, 1.35]%) and 1.47% (95% CI: [1.31, > 1.55]%), respectively. For G:F, the best-fitting models were QP [predicted equation: 0.750– 0.317 × (Lys) + 0.214 × (Lys)²] and LM [predicted equation: 0.392 + 0.241 × (Lys)], estimating the requirement at greater than 1.55% for both models. In conclusion, the estimated mean SID Lys required for nursery pigs from 6.8 to 15.9 kg ranged from 1.29% for maximum ADG to at least

1.55% for maximum G:F.

Key Words: growth, lysine, nursery pig

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Table 408. Effect of SID Lys on growth performance of 6.8 to 15.9 kg pigs

Item	SID Lys, %						SEM	Probability, $P <$	
	1.05	1.15	1.25	1.35	1.45	1.55		Linear	Quadratic
ADG, g	404	404	453	444	458	458	9.07	0.001	0.067
ADFI, g	616	621	653	635	612	599	13.61	0.158	0.019
G:F	0.651	0.652	0.699	0.704	0.752	0.768	0.009	0.001	0.349

409 Comparison of delayed weaning on lamb growth and parasitism while grazing red clover.

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The objective of this study was to compare weaning at 60 versus 100 d of age on lamb growth and parasitism while grazing red clover, followed by a feedlot phase where lambs were taken to a similar final weight. Each weaning treatment consisted of 3 replicate fields of 6 lambs per field, blocked by initial starting weight. Single lambs were used. Treatments were weaned (WEAN) lambs and lambs left with its mother for the pasture phase (NURSE). Paddock size matched stocking density between ewes with lambs and weaned lambs. At 100 d of age lambs were moved into a feedlot and finished on an 85% grain 15% forage diet to approximately 59 kg. Statistics were run using SAS Proc Mixed with PDIF for mean separation. At the end of the pasture phase, lamb live weight was greater ($P < 0.05$) for the NURSE lambs (LSM ± SEM) (38.92 ± 2.09 kg) compared with the WEAN lambs (31.82 ± 2.09 kg). When grazing pasture, ADG was greater ($P < 0.05$) for the NURSE (360 ± 27 g/d) compared with the WEAN (196 ± 27 g/d) lambs. Packed Cell Volumes were lesser ($P < 0.05$) for the WEAN lambs (30.9 ± 0.5) at 35 d than the NURSE lambs (34.2 ± 0.5). Fecal egg counts were not different for the WEAN lambs (66.4 ± 12.3) at 35 d compared to the NURSE lambs (31.9 ± 12.3) ($P > 0.05$). Weaning at 100 d produced greater gains and lower measures of parasitism on red clover compared to weaning at 60 d.

Key Words: Lamb, Growth, Weaning

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410 Effects of commercial formaldehyde inclusion and lysine level on nursery pig performance.

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Previous research has demonstrated that commercial formaldehyde products may reduce the risk of microbiological hazards

in feed, but there is concern about the product binding Lys and reducing growth performance. Therefore, the objective of this experiment was to evaluate the role of 2 commercially-available formaldehyde sources on growth performance of pigs fed a Lys-sufficient or Lys-deficient diet. A total of 299 pigs (PIC 327 × 1050; initial BW 15.2 kg) were used in a 14-d study. Dietary treatments were arranged in a 3 × 2 factorial design with 3 formaldehyde inclusions: none vs. 3.25 kg per tonne SalCURB (Kemin Industries, Inc., Des Moines, IA) vs. 3.0 kg per tonne Termin-8 (Anitox Corp, Lawrenceville, GA) and 2 Lys levels: Adequate (1.25% SID Lys) vs. Low (1.10% SID Lys). Product concentrations were established from supplier recommendations, and diets were treated with in commercial mills utilizing supplier-specific equipment. Pens of pigs were balanced by initial BW and randomly allotted to treatments with 5 pigs per pen and 10 pens per treatment. Data were analyzed in a factorial design using the GLIMMIX procedure of SAS. Overall, there was a tendency ($P < 0.10$) for a formaldehyde source × Lys level interaction to affect ADG and G:F. Pigs fed adequate Lys levels treated with no formaldehyde or SalCURB tended to have improved ($P < 0.10$) ADG and G:F compared to pigs fed adequate Lys levels treated with Termin-8. Pigs fed diets with low Lys and treated with Termin-8 tended to have poorer ($P < 0.10$) G:F than all other treatments. Regardless of source or Lys level, the inclusion of formaldehyde in nursery pig diets tended to reduce ($P < 0.10$) ADG and resulted in poorer ($P < 0.05$) G:F. Furthermore, the main effect of formaldehyde source affected ($P < 0.05$) ADG, G:F, and tended to affect ($P < 0.10$) ADFI, with pigs fed Termin-8 performing poorer than those fed SalCURB or no formaldehyde. As expected, Lys level affected ($P < 0.05$) ADG and G:F, but did not alter ADFI ($P > 0.10$). In summary, SalCURB inclusion did not alter nursery pig growth performance compared to the untreated basal diet, regardless of Lys level. However, the inclusion of Termin-8 tended to result in poorer G:F in adequate Lys diets and poorer ADG and G:F in low Lys diets compared to an untreated control.

Key Words: formaldehyde, lysine, nursery pigs
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411 Increased dietary soybean meal does not affect performance during a PRRSV-*Mycoplasma hyopneumoniae* challenge. A. L. O'Connell¹, W. P. Schweer¹, K. Schwartz¹, G. Gourley², M. A. FitzSimmons³, N. K. Gabler¹, ¹Iowa State University, Ames, ²Gourley Research Group LLC, Webster City, IA, ³Swine Graphics Enterprises, Webster City, IA.

Porcine reproductive and respiratory syndrome virus (PRRSV) and *Mycoplasma hyopneumoniae* (MHP) are 2 significant respiratory pathogens in finishing pigs, often found in tandem. Recent anecdotes have implied that increasing soybean meal content of diets can be beneficial in pathogen-challenged pigs,

while other reports suggest similar benefits by increasing the use of synthetic AA, specifically Trp. The objective of this study was to determine if increased synthetic Trp replacing a portion of SBM would impact performance of late finishing pigs dual-challenged with PRRSV and MHP. Ninety-six mixed sex pigs (120 ± 1.4 kg BW), were selected and randomly assigned to a high SBM (CON; 9 pens/trt) or synthetic Trp (SYN; 9 pens/trt) diet. Both diets were formulated to contain 0.70% TID Lys and were isocaloric; only crude protein was different between CON and SYN diets (15.9 vs. 13.5%, respectively). After 96 d on test diets, all pigs were inoculated intratracheally with MHP and intramuscularly with a field strain of PRRSV. Growth performance and feed efficiency were determined until pigs reached market weight (~138 kg BW), after which, carcass data and lung lesion scores were assessed. During the 96 d pre-challenge period, no performance differences were detected between the 2 dietary treatments. As expected, antibody titers for PRRSV and MHP increased post inoculation. However, change in PRRSV antibody titers from 0 to 28 d post inoculation tended ($P = 0.09$) to be increased in SYN versus CON pigs. MHP antibody titers and lung lesion scores did not differ between treatments. For the 28 d post-challenge period, there was no difference in ADG, ADFI or G:F. There was also no difference in hot carcass weight, yield percentage or muscle depth ($P > 0.10$). However, the SYN pigs had an increase in carcass fat depth compared to the CON ($P = 0.01$). Conversely, there was a tendency ($P = 0.09$) for carcass lean percent to be increased in CON pigs (57.6 vs. 57.1%, respectively). Altogether, these data indicate that diets with increased synthetic AA or decreased SBM do not alter pig performance during a late breaking respiratory health challenge.

Key Words: PRRSV, Soybean meal
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412 Concentrations of progesterone, estrogen, and insulin in serum during early pregnancy in crossbred Angus beef heifers Concentrations of progesterone, estrogen, and insulin in serum during early pregnancy in crossbred Angus beef heifers. T. L. Ellig¹, K. J. McLean¹, C. R. Dahlen^{1,2}, P. Borowicz^{1,2}, L. P. Reynolds^{1,2}, J. S. Caton^{1,2}, ¹North Dakota State University, Fargo, ²Center for Nutrition and Pregnancy, Fargo, ND.

Objectives were to evaluate circulating progesterone, estrogen, and insulin concentrations in beef heifers during the first 50 d of gestation. We hypothesized that concentrations of progesterone would remain constant during pregnancy while estrogen and insulin would fluctuate during the establishment of pregnancy. To address our hypothesis, crossbred Angus heifers ($n = 46$), were synchronized, bred via AI and fed to gain 0.22 kg/d. Blood samples were taken via jugular venipuncture on d 16, 22, 28, 34, 40, and 50 of gestation. Non-bred, non-pregnant control heifers were sampled on d 16 of