

min), and in plant C carcasses were directly transported to the cold storage (1-3°C, AV 2m/s). All carcasses were chilled until 20 h postmortem when meat quality was measured in the loin (3rd/4th lumbar vertebra). From October to March, 9 batches of ~150 pigs each (halothane-negative, average carcass weight 87kg) were purchased at commercial farms, divided in three and sent to the plants on three consecutive days. Feed withdrawal, transport and lairage time were identical for the three plants within batch. At 30 min postmortem pH was measured: plant A and C showed a lower pH₃₀ than plant B (A: 6.50 and C: 6.53 vs. B: 6.70, P<.001). After 4 h, pH was highest at plant B and lowest at plant C (A: 6.06 vs. B: 6.12 vs. C: 5.99, P<.001). Ultimate pH (pH_u) was lowest for plant C (5.62), intermediate for plant B (5.68) and highest for plant A (5.71, P<.001). In agreement with other measurements, drip losses (DL) differed between plants (P=.057) with highest DL found at

plant C (C: 5.2% vs. A: 4.8%, P<.05, B: 5.0%, P>.10). The plants ranked the same with regards to conductivity as with DL (A: 5.5 vs. B: 6.5 vs. C: 7.4 mS, P<.001). Although instrumental color measurement (Minolta) did not show significant differences, visual scoring (Japanese color scale, 1-6, 6 being darkest) revealed a paler color for plant C (A and B: 2.9 vs. C: 2.7, P<.001). Correlations (corrected for plant, batch and day of slaughter) were low to moderate: DL showed highest correlation with conductivity (r=.63) but lower correlations with pH₃₀, pH_{4h} and pH_u (pH₃₀: r=-.38, pH_{4h}: r=-.38, pH_u: r=-.45). It is concluded that processing plant can affect meat quality with differences being most likely related to pre-slaughter stress, stunning and/or cooling systems.

Key Words: Pork quality, Stunning, Cooling

ASAS Nonruminant Nutrition: Health, Nutrition Interactions

88 Use of menhaden oil to alter n-6:n-3 fatty acid ratios in nursery pig diets. T. A. Meyer*, M. D. Lindemann, G. L. Cromwell, and H. J. Monegue, *University of Kentucky, Lexington, KY.*

Weanling pigs (n=125, 21.4 d of age, and 6.8 kg BW) were used in two 28-d experiments to evaluate five dietary n-6:n-3 fatty acid (FA) ratios on performance, cell-mediated immunity, and intestinal morphology. Pigs were blocked by weight and randomly allotted to five pigs/pen. Complex diets with 5% oil (menhaden, corn, or a mixture) and calculated n-6:n-3 FA ratios of 0.7, 1.9, 6.9, 35.5, and 70.0 were then randomly allotted to pens within a replicate. Diets were formulated to contain 1.28% lysine; all other nutrients met or exceeded requirement estimates (NRC, 1998). Pig weights and feed consumption were recorded weekly. Cell-mediated immunity was assessed on d 14 and 28 by measuring the inflammatory response to an intradermal injection of phytohemagglutinin solution in the ear. One pig/pen was euthanized on d 28 and sections of duodenum and jejunum were taken to measure villi height and crypt depth. No overall differences (P = 0.10) in ADG (402, 448, 433, 456, and 428 g/d), ADFI (608, 677, 694, 709, and 656 g/d), or F/G (1.52, 1.51, 1.61, 1.56, and 1.53) occurred with increasing n-6:n-3 ratios. The inflammatory response (1.02, 1.00, 0.99, 0.93, and 0.96; 0.90, 0.86, 0.83, 0.95, and 0.85 mm) did not differ (P = 0.10) with increasing n-6:n-3 ratios on d 14 or 28, respectively. Duodenum crypt depth did not differ with increasing n-6:n-3 ratios (220, 215, 231, 213, and 225 mm; P = 0.10), but a quadratic effect occurred in jejunum crypt depth (239, 244, 252, 259, and 233 mm; P < 0.05). The duodenum and jejunum villi height (394, 394, 411, 407, and 364; 408, 432, 431, 415, and 424 mm), and villi height:crypt depth ratios (1.92, 1.93, 1.89, 2.07, and 1.70; 1.78, 1.86, 1.77, 1.68, and 1.91) did not differ (P = 0.10) among dietary treatments. Alteration of dietary n-6:n-3 FA ratios did not influence performance or skin inflammatory response to PHA, but did have a small effect on intestinal morphology.

Key Words: Pigs, Fatty acids, Performance

89 Response of early-weaned pigs to pea protein isolate-based diets supplemented with chicken egg-yolk anti-E. coli (K88) antibody. A. Owusu-Asiedu*¹, R. R. Marquardt¹, C. M. Nyachoti¹, and S. K. Baidoo², ¹University of Manitoba, Winnipeg, Manitoba/Canada, ²University of Minnesota, Minneapolis, Minnesota/USA.

In practical swine production, enterotoxigenic *E. coli* (ETEC) infection and resulting scours is a major problem for young pigs especially where purified plant proteins compared to spray-dried porcine plasma (SDPP) are fed. The effect of supplementing a pea protein isolate (PPI)-based diet with egg-yolk antibodies (EYA) obtained from laying hens immunized with ETEC K88 on piglet performance and incidence of scours was studied in a 14-d experiment. Ninety 10-d old weaned pigs were assigned to 5 dietary treatments in a completely randomized design to 6 replicate pens per treatment. The treatments were PPI, PPI + EYA, SDPP, SDPP + EYA and PPI + SDPP. All diets were formulated to similar nutrient levels and provided for ad libitum consumption. On d 7, piglets were orally challenged with 6 ml of ETEC K88 dose of 10¹² CFU ml⁻¹. Piglets were weighed on d 7 and every other d after ETEC challenge. Weekly feed intake, BW change and number of piglets with scours and scour score were recorded. Fecal swabs from 10 pigs per treatment were taken for polymerase chain reaction (PCR) test to detect *E. coli* K88.

Feed efficiency ranged from 1.3 to 1.4 and was not affected (P>0.05) by dietary treatment. Mean daily feed intake was lower (P<0.05) in piglets fed diet PPI (64.3 g/d) compared to PPI + EYA (94.8 g/d) during WK 1. Piglets fed PPI without EYA had lower (P<0.05) ADG (84.0 g/d) compared to those fed PPI + EYA (123.0 g/d) or SDPP-based diets. Scour appeared in all groups of pigs 4-6h after ETEC K88 oral challenge. However, piglets fed PPI + EYA or SDPP-based diets recovered after 10h post-challenge, whereas those fed PPI continued to have severe diarrhea resulting in 46.5% mortality. PCR results showed that all PPI fed piglets continued to shed ETEC K88 at the end of the 14-d experimental period. It was concluded that specific EYA and SDPP can provide passive control of ETEC (K88) infection and potentially improve feed intake and weight gain in early-weaned pigs fed PPI

Key Words: Porcine plasma, *E. coli*, Scours

90 High levels of dietary ascorbic acid on liver gulonolactone oxidase activity, serum and liver ascorbic acid concentration, and growth performance of postweaning pigs. S. Ching*¹ and D.C. Mahan, ¹The Ohio State University.

Pig liver ascorbic acid synthesis activity was found to be suppressed while nursing the sow, but increased during the initial 2 wk postweaning. Blood and tissue ascorbic acid concentration declined postweaning and continued at a low concentration for several weeks. This experiment therefore evaluated the effects of feeding high dietary vitamin C levels on liver gulonolactone oxidase (GLO) activity, tissue ascorbic acid contents, and growth performance during a 38 d postweaning period. A randomized complete block design was conducted with four levels of dietary ascorbic acid (0, 500, 1000, 3000 ppm) in 12 replicates. Diets were comprised using typical Phase 1, 2, and 3 starter pig diets, except that a stabilized form of vitamin C (Stay C ? 35%) was used. A total of 260 crossbred pigs was weaned at 17 d of age and averaged 6.2 kg BW. At the end of each phase (10, 24, and 38-d postweaning) pigs were weighed and feed consumption measured. Pigs were bled at each period with the serum analyzed for ascorbic acid. Two pigs per treatment group were killed at the end of each period and liver GLO activity and ascorbic acid concentration determined. Daily gains (P < 0.05) and G/F ratio (P < 0.10) increased linearly as dietary ascorbic acid increased during the 0 to 10-d period, but not thereafter. Liver GLO enzyme activity decreased linearly (P < 0.01) at 10, 24, and 38 d as dietary vitamin C increased. As dietary vitamin C levels increased, serum ascorbic acid (P < 0.01), liver ascorbic acid (P < 0.01), and urinary ascorbic acid (P < 0.01) increased at 10, 24, and 38-d postweaning. These results indicate that high levels of dietary vitamin C suppressed vitamin C synthesis in the pig, but stimulated pig growth and feed efficiency during the initial 10-d postweaning with higher serum, tissue, and urinary ascorbic acid concentrations.

Key Words: Ascorbic acid, Gulonolactone oxidase, Weanling pigs

91 High levels of dietary ascorbic acid on liver gulonolactone oxidase activity, serum and liver ascorbic acid concentration, and growth performance of postweaning pigs. S. Ching* and D.C. Mahan, *Ohio State University.*

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Key Words: Ascorbic Acid, Weaning, Pigs

92 Effects of brewers dried yeast as a source of mannanoligosaccharides and of carbadox on total, *Escherichia coli* K88, and carbadox-resistant coliform populations in early-weaned pigs. L. A. White*, M. C. Newman, G. L. Cromwell, and M. D. Lindemann, *University of Kentucky, Lexington, KY.*

Effects of brewers dried yeast, as a source of mannanoligosaccharides (MOS), and carbadox on enteric microbial populations in young pigs were evaluated. In two trials, pigs ($n = 12$ /trial) were weaned at 11 d of age (4.1 kg BW) and placed in isolation chambers (two pigs/chamber) equipped with individual air filtering systems and excrement containers. Treatments were a non-medicated basal diet, a diet with 55 mg/kg of carbadox, and a diet with 3% yeast. Diets were fortified corn-soy-dried whey-lactose-animal plasma and contained 1.5% lysine (total). Diets were fed for 29 d, then each pig was bled and orally dosed with approximately 9.5×10^8 CFU of *E. coli* K88. Fecal swabs were collected daily from inoculation (d 0) to d 10. Total, K88, and carbadox-resistant coliforms were enumerated daily, and total serum protein levels were measured from blood sampled on d 0 and d 10. All pigs were killed on d 10 (18.5 kg BW) and bacterial samples were obtained from the intestinal wall of the small intestine, cecum, and colon. Agglutination tests confirmed adsorption of K88 and other serovars of *E. coli* and *Salmonella* spp. with yeast. A few differences among pigs fed the basal, carbadox, or yeast diets were detected in total coliform (2.9, 2.6, 2.6 log CFU/g tissue), *E. coli* K88 (1.6, 1.4, 1.6), and carbadox-resistant (1.7, 1.3, 1.6) populations in the small intestine, cecum (5.7, 4.6, 5.2 [$P < 0.05$]; 2.4, 2.6, 3.1; 2.8, 2.4, 2.5), and colon samples (5.8, 5.4, 5.4; 2.7, 3.2, 2.9 [$P < 0.05$]; 3.1, 3.4, 3.2). Daily fecal K88 counts were not different ($P > 0.05$) among treatments, but counts of carbadox-resistant coliforms were higher ($P < 0.05$) throughout the 10-d period in the carbadox vs basal or yeast treatments. Serum protein levels were higher ($P < 0.05$) for the yeast group on d 0 (2.4, 3.1, 3.4 g/dl serum) but not at termination (4.7, 5.0, 4.7). In this trial, brewers dried yeast and carbadox had minimal effects on microbiological and immunological traits in early-weaned pigs.

Key Words: Pigs, Coliforms, Yeast

93 The effect of feeding spray-dried porcine plasma and egg immunoglobulins with anti-bacterial or anti-somatostatin specificities on the performance of weaned pigs. M. D. Drew* and A. E. Estrada, *University of Saskatchewan, Saskatoon SK Canada.*

A total of 120 weanling pigs (18 d of age; 6.0 Kg mean weight) were used to evaluate the effect of feeding porcine plasma (PP) with two different egg immunoglobulin (Ig) products. The first egg Ig was produced by immunizing laying hens with a bacterin containing *E. coli* F4, *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Enterococcus faecalis*, *Klebsiella pneumoniae* and *Clostridium perfringens*. The second egg

Ig was produced by immunizing hens against a somatostatin (SRIF)-bovine serum albumin conjugate. The eggs were spray-dried before use. Thirty pigs (5 per pen) were randomly assigned to one of four diets: 1) Control-containing no plasma or egg, 2) Plasma-control diet with 2.5% PP added, 3) Bacterial Egg-control diet with 1.0% PP; 0.5% anti-bacterial egg added and 4) SRIF Egg-control diet with 1.0% PP; 0.5% anti-SRIF egg added. The diets were not pelleted and provided equal crude protein, lysine, methionine, threonine and digestible energy. Pigs were fed ad libitum and pig weights and feed intakes were measured on days 0, 7 and 14. During the first 7 days, pigs receiving the SRIF egg diets had significantly higher average daily gains (ADG) ($P < 0.05$) compared to the controls (143 g/d vs 83 g/d). Plasma or Bacterial Egg fed pigs had ADG (121 g/d and 128 g/d respectively) which were not significantly different from the Controls or SRIF egg groups. The Plasma fed pigs had higher ($P < 0.05$) average daily feed intakes (ADFI) than the other three groups during the first week of the experiment. Feed:gain ratios (F:G) were reduced ($P < 0.05$) in the pigs fed the Bacterial or SRIF egg diets (1.19 and 1.09 respectively) compared to the controls and Plasma diet fed pigs (1.79 and 1.50 respectively). No significant differences were seen during the second week of the experiment. The results suggest that anti-bacterial or anti-SRIF egg Igs combined with low levels of plasma can increase the growth and feed efficiency of weaned pigs.

Key Words: Pig, Immunoglobulin, Somatostatin

94 Pre- and postweaning performance of piglets fed pre-weaning diets containing either spray-dried porcine plasma, whey protein concentrate or whey powder. A.J. Van Dijk*¹, M. Ubbink-Blanksma¹, J.G.P. Van der Palen¹, and A.C. Beynen², ¹*Co-operative Central Laboratory Nutritional Control Cheve, P.O. Box 107, 5460 AC Veghel, The Netherlands,* ²*Dept. Nutrition, Utrecht University, Veterinary Faculty, P.O. Box 80152, Utrecht, The Netherlands.*

We studied the effect of the addition of either delactosed whey powder (WP), spray dried porcine plasma (SDPP) or whey protein concentrate (WPC) to creep feed on pre- and post-weaning performance and health of piglets. Inclusion levels in the diets were 17.7, 5.0 and 13.1 %, respectively. SDPP or WPC were exchanged for WP in the control diet on an isonitrogenous basis. During the period from thirteen days before weaning until weaning, the piglets (17 litters per treatment) were offered one of the three experimental creep feeds followed by a weaner diet after weaning, that was identical for all three treatment groups. During the pre-weaning period there were no significant differences in feed intake and daily gain between the treatment groups (Table 1). During the first week after weaning, the piglets that had been fed the SDPP diet before weaning, had a significantly higher average daily feed intake (ADFI) than did the piglets that were fed the WPC diet before weaning. During the fourth week after weaning, the piglets given the creep feed with SDPP diet before weaning had a significantly higher average daily gain (ADG) and lower feed conversion ratio (FCR) than the piglets that were fed the creep feed with WP. For the entire post-weaning period there were no major differential effects on ADG, ADFI and FCR as mediated by either SDPP, WPC or WP in the creep feed. It is concluded that the type of protein in creep feed can have carry-over effects on post-weaning growth performance.

Diet	WP	SDPP	WPC	SEM
ADG (g/day)				
14 days before weaning until weaning	295	310	314	9
After weaning, days:				
1-7	162	170	167	16
8-14	290	333	321	21
15-21	428	464	454	24
22-28	550 ^a	621 ^b	586 ^{ab}	24
ADFI (g/day)				
14 days before weaning until weaning	12	15	13	2
After weaning, days:				
1-7	171 ^{ab}	192 ^a	156 ^b	11
8-14	361	399	383	21
15-21	616	692	633	36
22-28	837	909	912	33

^{a,b}Means within the same row without a common superscript letter differ significantly ($P < 0.05$).

Key Words: Piglet, Creep-feed, Protein

95 Evaluation of Termin-8[®] addition to spray-dried animal plasma or base mix on growth performance of nursery pigs. J.M. DeRouchey^{*1}, R.E. Musser², W.N. Cannon³, M.D. Tokach¹, J.N. Nelssen¹, R.D. Goodband¹, and S.S. Dritz¹, ¹Kansas State University, Manhattan, ²The Pork Group, Rogers, AR, ³NutraBlend, Neosho, MO.

A total of 1698 pigs (BW of 5.0 kg and 17 d of age) were used in a 13 d growth assay to determine the effects of Termin-8[®] (Anitox Corp.) addition to the spray-dried animal plasma (SDAP) or base mix portion of a SEW diet on growth performance in nursery pigs. Termin-8[®], an antibacterial feed additive, contains a mixture of aliphatic acids, formaldehyde, and natural terpenes. Pigs were housed in a commercial research nursery with 12 to 19 pigs per pen (uniform within each block) and 36 pens per treatment. Pigs were allotted to one of three SEW dietary treatments. The treatment diets included: 1) control diet (1.67% lysine, 7% SDAP); 2) control diet with Termin-8[®] application (3 g/kg) to the SDAP portion of the diet; and 3) control diet with Termin-8[®] application (3 g/kg) to the base mix portion (specialty protein products, milk products, oat groats, vitamins, minerals, and antibiotic) of the diet. All pigs were fed 2.27 kg of their respective treatment diet and then a common transition diet (1.47% lysine) for the remainder of the treatment period. For d 0 to 8, pigs fed diets containing Termin-8[®] in the SDAP or base mix portions had increased ($P < .01$) ADG and gain/feed compared to the pigs fed the control diet. Also, pigs fed SDAP with Termin-8[®] treatment had greater ADG ($P < .01$) and tended to have improved gain/feed ($P < .07$) compared to pigs fed Termin-8[®] treated base mix. Overall (d 0 to 13), ADG ($P < .01$) and gain/feed were greater ($P < .05$) for pigs fed diets containing Termin-8[®] treatment to the SDAP or base mix portion compared to pigs fed the control diet. In conclusion, adding Termin-8[®] to the SDAP or base mix at 3 g/kg before diet manufacturing improved pig performance.

Item	Termin-8 [®] Application			SEM
	Control	Plasma	Base Mix	
d 0 to 8				
ADG, g	171	222	205	5.7
ADFI, g	176	183	184	5.2
G/F, g/kg	1005	1232	1125	38
d 0 to 13				
ADG, g	219	251	246	6.6
ADFI, g	259	265	265	7.9
G/F, g/kg	846	947	928	31

Key Words: Pig, Growth, Termin-8[®]

96 Dietary supplementation of different organic acids as an alternative to the use of antibiotics in the diets of early-weaned piglets. M. Borysenko^{*}, M.Z. Fan, T. Archbold, J.L. Atkinson, C. Dewey, and H. Engelhardt, University of Guelph, Guelph, Ontario, Canada.

The objective of this study was to evaluate the use of organic acids as alternatives to antibiotics in the diets of early-weaned piglets. Average daily gain, feed efficiency, organ weight gain, diarrhea scores, white blood cell counts and blood urea nitrogen (BUN) were the endpoints measured. A total of 216 Yorkshire piglets, weaned at the age of 14 d with an average BW of 4.71 kg, were used in the study. A randomized complete block design was used. Pigs were blocked by replication time, equalized for gender, allotted to one of six treatments using six pigs per pen and six replicate pens per treatment. Animals were housed in a nursery in raised pens with rubberized woven wire floors with free access to feed and water. Six diets were used: control diet (CD, antibiotic Lincomix 44 at 1 kg/tonne of feed), negative control (NC, no antibiotic) and lactic (LAD), formic (FAD) and fumaric acid (FUM) diets containing 0.65% organic acid. A low cost diet (LCD) contained 0.2% of each acid. Piglets were fed the diets from d 1 to 20 post-weaning. All endpoint measurements were taken at d 10 and 20. One representative male and female piglet from each treatment group were sacrificed and

samples (blood, stomach, liver, spleen, proximal and distal small intestine) taken. The CD group had a higher ($P < 0.05$) growth rate at d 20 post-weaning than the NC, LAD, FAD, FUM and LCD groups (146.7 vs. 133.5, 136.6, 133.1, 133.2 and 117.1, SEM = 2.4g/d). BUN at d 20 was lower ($P < 0.01$) in the CD group than in the other treatment groups (4.33 vs. 5.39, 5.85, 5.67, 6.60 and 7.27, SEM = 0.44 mmol/L). There were no differences ($P > 0.05$) between treatment groups for the remaining measurements. In conclusion, organic acid supplementation does not improve growth performance of early-weaned piglets under our experimental conditions. BUN is a more sensitive indicator of growth and protein metabolism than the other parameters examined.

Key Words: Organic acids, Early-weaned piglets, Antibiotics

97 Effects of ractopamine on pigs fed diets with and without vitamin and trace mineral premixes in late finishing (90 kg to slaughter). C. W. Starkey^{*}, J. D. Hancock, G. A. Kennedy, C. L. Jones, D. J. Lee, C. M. Dodd, and J. D. Dunn, Kansas State University, Manhattan.

A total of 192 pigs (avg initial BW of 90 kg) were used to determine the effects of ractopamine (RAC) on finishing pigs fed diets with and without vitamin and trace mineral premixes (VTM). The pigs were blocked by sex and weight and allotted to 16 pens with 12 pigs per pen. Treatments were arranged as a 2 x 2 factorial with main effects of VTM status (with vs without) and RAC treatment (none vs 19.8 g/ton of feed). The treatments were administered for the last 25 d before slaughter. Diets were corn (ground to 600 microns)-soybean meal-based with 1% lysine, 0.65% Ca, 0.55% P, and 2% added fat. The diets were fed in meal form and consumed on an ad libitum basis. Deletion of VTM did not affect growth performance ($P > 0.2$) or last rib backfat thickness ($P > 0.9$), but addition of RAC increased ADG ($P < 0.03$), tended to increase gain/feed ($P < 0.06$), and decreased last rib backfat thickness ($P < 0.01$). There was a tendency, however, for the beneficial effects of RAC on backfat thickness to be expressed only when the VTM were in the diets (VTM x RAC interaction, $P < 0.06$). The number of broken vertebrae was decreased when RAC was added to diets with VTM but was largely unaffected when RAC was added to diets without VTM (VTM x RAC interaction, $P < 0.02$). Deletion of VTM and additions of RAC did not affect scores for stomach ulcers ($P > 0.33$). In conclusion, there was no evidence to suggest negative effects in either growth performance or carcass measurements when RAC was added to diets without VTM.

Item	With VTM				SE
	Without RAC	With RAC	Without RAC	With RAC	
ADG, kg	1.04	1.08	1.00	1.09	0.03
ADFI, kg	2.70	2.67	2.71	2.75	0.04
Gain/feed	0.386	0.406	0.367	0.395	0.012
Backfat thickness,mm	26	24	25	25	1
Broken vertebrae	0.47	0.08	0.21	0.26	0.11
Stomach ulcers	0.06	0.00	0.05	0.08	0.05

Key Words: Pigs, Vitamin and mineral premix, Ractopamine

98 Effects of ractopamine on pigs fed diets with and without vitamin and trace mineral premixes in the finishing phase (70 kg to slaughter). C. W. Starkey, J. D. Hancock^{*}, G. A. Kennedy, C. L. Jones, D. J. Lee, C. M. Dodd, and J. D. Dunn, Kansas State University, Manhattan.

A total of 192 pigs (avg initial BW of 70 kg) were used to determine the effects of ractopamine (RAC) on finishing pigs fed diets with and without vitamin and trace mineral premixes (VTM). The pigs were blocked by sex and weight and allotted to 16 pens with 12 pigs per pen. Treatments were arranged as a 2 x 2 factorial with main effects of VTM status (with vs without) and RAC treatment (none vs 19.8 g/ton of feed). The treatments were administered for the last 50 d before slaughter. Diets were corn (ground 600 micron)-soybean meal-based with 1.2% lysine, 0.65% Ca, and 0.55% P, for 70 to 90 kg BW and 1% lysine, 0.65% Ca, and 0.55% P for 90 to 118 kg BW. The diets were fed in meal form and consumed on an ad libitum basis. No interactions were observed among the VTM and RAC treatments for ADG, ADFI, or gain/feed ($P > 0.2$). Deletion of VTM premixes from 70 kg to slaughter decreased overall ADG ($P < 0.01$) with no effects on ADFI ($P > 0.09$) or gain/feed ($P > 0.23$). Addition of RAC did not affect overall ADG ($P > 0.23$), but decreased ADFI ($P < 0.01$) and increased gain/feed ($P < 0.04$).

There were no interactions among the VTM and RAC treatments for last rib backfat thickness, broken vertebrae, or scores for stomach ulcers ($P > 0.21$). Also, deletions of VTM premixes did not affect these same measurements ($P > 0.22$). However, RAC decreased ($P < 0.01$) backfat thickness by 8% and tended to decrease scores for stomach ulcers ($P < 0.06$). In conclusion, there were no interactions to suggest that the effects of RAC on growth performance and carcass leanness were altered by deletion of VTM.

Item	With	VTM	Without	VTM	SE
	Without RAC	With RAC	Without RAC	With RAC	
ADG, kg	1.09	1.09	1.02	1.06	0.02
ADFI, kg	2.95	2.65	2.82	2.60	0.08
Gain/feed	0.371	0.413	0.361	0.408	0.008
Backfat thickness, mm	18	17	20	17	1
Broken vertebrae	0.27	0.28	0.09	0.35	0.10
Stomach ulcers	0.01	0.00	0.04	0.00	0.01

Key Words: Pigs, Vitamin and mineral premix, Ractopamine

ASAS/ADSA Breeding and Genetics: Breeding Strategies for Dairy Cattle

99 Evaluation of corrective mating programs for dairy cattle in the U.S. E.N. Sonnek*, L.B. Hansen, and A.J. Seykora, *University of Minnesota, St. Paul, MN.*

Corrective mating programs have been popular with dairy producers for many years, and recently they have been promoted as tools to avoid inbreeding. Six AI companies, two breed associations, and one commercial vendor answered a 42-question survey on the details of their corrective mating programs. The total number of cows mated annually in the US is about 2.7 million with individual programs ranging from about 90,000 to about 600,000. Corrective mating programs use phenotypes and PTAs for multiple traits (including production and type) to optimize mate selection. All of the programs mate heifers by PTAs from pedigrees, by phenotype on linear type traits, or a combination of the two. Most of the programs are run on a laptop on the farm or on a PC in the evaluator's office. Two programs are run strictly from the organization's headquarters. All programs are flexible regarding which traits of animals are used as well as methods for sire selection. When gathering pedigrees on females, six of the programs use only sire and maternal grandsire (MGS). Of these six, five programs use three-generation pedigrees of the selected mate, the female's sire, and MGS to check for common ancestors. Of these five, three check for common ancestors only among the males of these three-generation pedigrees. The sixth program (that gathers only the female's sire and MGS) utilizes complete pedigrees back to the 1960's. Two programs gather the maternal great-grandsire of the female in addition to the sire and MGS. One of these programs uses a three-generation pedigree including males and females while the other uses a five-generation male only pedigree when checking for common ancestors. Finally, only one program uses full pedigrees of selected mates and females back to the 1960's when calculating inbreeding coefficients. Obviously, great differences exist on the depth of pedigrees utilized to accurately prevent inbreeding depression. A significant portion of potential inbreeding is not detected if only a few generations are used, especially considering that the two bulls with highest relationship to the breed would appear several generations back in pedigrees.

Key Words: Corrective mating, Negative assortive mating, Inbreeding

100 Analysis of the relationship between linear type traits, inbreeding, and survival in US Jersey cows. Daniel Z. Caraviello*, Kent A. Weigel, and Daniel Gianola, *University of Wisconsin, Madison WI/USA.*

The ability of a dairy cow to resist involuntary culling is of high economic importance to the dairy farmer. Genetic improvement of survival can lead to lower replacement costs, decreased veterinary costs, more opportunities for voluntary culling, and a higher proportion of cows producing at a mature level. The objective of this study was to evaluate the relationship between linear type traits and survival in Jersey cattle. Because some traits may have an intermediate optimum or a threshold above which there is little impact on culling, we were interested in both linear and nonlinear relationships. Data for this study were obtained from USDA Animal Improvement Programs Laboratory, and these included 124,953 Jersey cows in 2258 herds with first calving between January 1, 1981 and December 31, 1993. Average age at termination was 1978 days. Our model included the effects of herd, year of calving, season of calving, age at first calving, and within-herd quartiles for mature equivalent milk, fat, and protein yield in the terminal lactation. Linear and quadratic regression coefficients corresponding to inbreeding coefficients and thirteen linear type traits were added to the

model one at a time. Linear regressions on strength, dairy form, foot angle, rear legs side view, rump angle, thurl width, fore udder, rear udder height, rear udder width, udder depth, suspensory ligament, and front teat placement were all positive and significantly different from zero. Quadratic effects of strength, foot angle, rear legs side view, rump angle, thurl width, fore udder, rear udder height, rear udder width, udder depth, suspensory ligament, and front teat placement were all significant and negative, indicating the likelihood of nonlinear relationships between type traits and survival. Inbreeding had a highly significant negative relationship with survival; a one percent increase in inbreeding resulted in a decrease in survival of approximately 40 days. Results of the linear model analysis will be verified using survival analysis methodology.

Key Words: Survival, Type Traits, Inbreeding

101 Effects of information in pedigrees on estimates of inbreeding depression for days to first service and summit milk yield. B. G. Cassell* and V. Adamec, *Virginia Polytechnic Institute and State University.*

Data from Holstein cows processed by DRMS Raleigh were used to estimate inbreeding depression in number of days to first service and summit milk yield. Pedigree information on all cows in this study was retrieved from AIPL, Beltsville, MD and combined with cow records. A procedure based on contribution of each ancestor in a five-generation pedigree to inbreeding coefficient was used to evaluate percentage of information present in cow pedigrees. Four groups of herds with about 50,000 cows each were randomly selected from the data. Group one included herds of grade cows where at least 85% of cows had 0-30% of available pedigree. Groups two (grade, 31-70%), three (grade, 71-100%) and four for herds with registered cows above 70% pedigree were formed similarly with 7% of herds contributing data to both group 3 and group 4. Inbreeding was calculated using standard methods and averaged 0.03%, 1.8%, 2.0%, and 3.7% for groups 1 to 4, respectively. Standard deviations were 0.7%, 2.0%, 2.2%, and 2.4% for the same groups. Mixed models for the two traits included herd-year-season (random), lactation number, inbreeding covariate, animal and permanent environmental effects associated with a cow. Three generations of pedigree were used in the numerator relationship matrix. Estimates of inbreeding depression from MTDFREML analysis of days to first service were -0.23 ($p=0.10$), 0.07 ($p=0.13$), 0.15 ($p=0.003$) and 0.03 ($p=0.27$) days for groups 1 to 4. Summit milk yield averaged between 36-38 kg in all groups, with estimated inbreeding depression of -0.12, -0.06, -0.06, and -0.07 kg. Effects of inbreeding were significantly different from zero ($p<0.001$) with significance increasing from group 1 to group 4. Estimates of inbreeding depression for days to first service were greater from grade herds with more pedigree data, a trend not confirmed in registered cows.

Key Words: Days to first service, Summit milk, Inbreeding depression, Pedigree

102 Minimization of rate of inbreeding for populations with overlapping generations combining live and frozen genetics. A.K. Sonesson* and T.H.E. Meuwissen, *Institute of Animal Science and Health, Lelystad, The Netherlands.*

We present a method that minimizes the rate of inbreeding (ΔF) for small unselected populations with overlapping generations. It minimizes the increase of coancestry of parents and optimizes the contribution of