

litter performance. However, bow-bar crate type resulted in more pigs and heavier litter weights at 21d.

Key Words: Swine, Farrowing, Litter

1142 Supplemental feeding lactating Fallow does increased body condition score and circulating leptin but failed to improve reproductive efficiency. K. C. Candler^{*1}, C. G. Brown¹, D. A. Neuendorff¹, A. W. Lewis¹, J. A. Sterle², D.H. Keisler³, and R. D. Randel¹, ¹Texas Agricultural Experiment Station, Overton, ²College Station, ³University of Missouri, Columbia.

Gestating does (*Dama dama*); (BW=51.3kg) were allotted into groups: 1) Control (C; No Supplement n=12), 2) Supplement (S; 4:1, corn:soybean meal n=12), or 3) Rice Bran (R; 3:1:1, corn:soybean meal:20% fat rice bran n=12) formulated to be isonitrogenous and isoenergetic and grazed Coastal bermudagrass/ryegrass pastures. S and R were fed .5kg ration/head/day for 112d. All does were weighed, body condition scored (BCS), and blood sampled at 7d intervals for 14d prior to and for 35d after weaning. Serum progesterone (P4) and leptin concentrations were determined using RIA. Pregnancy was determined by ultrasonography 30 and 75 d after buck exposure. S does tended ($P<.075$) to lose less weight ($-.062\pm.004\text{kg/d}$) than C ($-.073\pm.004\text{kg/d}$) or R ($-.071\pm.004\text{kg/d}$). C does tended ($P<.08$) to have lower BCS than R but were lower ($P<.002$) than S. S does lost less ($P\pm.001$) BCS ($-.636\pm.310$) than C ($-2.167\pm.297$) with R being intermediate ($-1.432\pm.310$). Fawn birth weights did not differ ($5.2\pm.2\text{kg/d}$, $5.1\pm.2\text{kg/d}$, $5.3\pm.2\text{kg/d}$; C, S, and R, respectively). C fawns had the lowest ($P<.003$) ADG ($.128\pm.010\text{kg}$), S the highest ($.185\pm.010\text{kg}$) and R intermediate ($.162\pm.010\text{kg}$). Serum leptin (ng/ml) increased over time ($P<.001$) and differed by treatment ($P<.06$) with S being the highest and C and R being similar ($P<.10$) and lowest. Prewaning P4 was higher ($P<.003$) in S ($2.4\pm.2\text{ng/ml}$) than either C ($1.5\pm.2\text{ng/ml}$) or R does ($1.7\pm.2\text{ng/ml}$). 100% of S does were estrous cycling before weaning compared with 66% of C and 75% of R. Postweaning P4 increased over time ($P<.0001$) but was not affected by treatment ($P>.10$). By d 30 of the breeding season, 100% of S does were pregnant compared with 91% of C and R and all does were pregnant by d 75. Inclusion of rice bran failed to improve performance but supplement corn and soybean meal supplement increased

BCS and circulating leptin. Weaning and buck exposure resulted in equal breeding performance in thinner does.

Key Words: Rice bran, *Dama dama*, Dietary energy

1143 Angus steer performance grazing bermudagrass on degraded soils fertilized with poultry litter, ammonium nitrate, or crimson clover. D. H. Seman^{*1}, J. A. Stuedemann¹, and A. J. Franzluebbers¹, ¹USDA-ARS, Watkinsville, GA USA 30677.

We have been investigating the impact of using cattle in forage systems to restore degraded cropland in the Southeastern US. The object of this study was to evaluate performance of steers grazing bermudagrass pastures that were fertilized by three fertilizer treatments and were stocked at two grazing pressures. Yearling Angus steers were randomly assigned to 18 paddocks (.65 to .75 ha) which were organized in three blocks. Three nitrogen (N) treatments included N provided as ammonium nitrate (M), poultry litter (L) or by crimson clover plus ammonium nitrate (C). Ammonium nitrate and L were applied twice each year to annually provide 200 kg N/ha. Cattle grazed for 140 days from mid-May until mid-October for five years. The high grazing pressure (HP) was to maintain 1,500 kg forage/ha and low grazing pressure (LOW) maintained 3,000 kg/ha with a differential of 1,500 kg/ha between both rates. Stocking rates were adjusted every 28 days by put-and-take. After five years, the M treatment had greater average total grazing days (1,092) than C (926) and L (944), ($P<.05$). The L treatment had less total animal gain/ha, 607 kg/ha than did M (733 kg/ha) and C (688 kg/ha) treatments ($P<.05$). Average daily gain (ADG) was greater for C (.78 kg/d) than L (.69 kg/d) ($P<.05$) with M intermediate (.74 kg/d). Steers grazing HP had 1,118 grazing days vs. 857 LOW ($P<.05$). Steers grazing HP had greater total animal gain/ha, 732 than LOW with 620 kg/ha ($P<.05$). Steers grazing LOW had greater ADG .82 kg/d than HP .65 kg/d ($P<.05$). Steers exhibited excellent gains while grazing bermudagrass during summer. Poultry litter supported acceptable steer production even though animal production was less than M and C. Soil organic carbon was positively correlated with grazing days $r=.49$ ($P=.0378$). Results imply that grazing cattle can be employed to restore eroded cropland.

Key Words: Poultry Litter, Beef Cattle

ASAS/ADSA Animal Behavior and Well Being

1144 Quiet handling of heifers reduces aversion to restraint. V. Littlefield¹, T. Grandin¹, and J. L. Lanier^{*1}, ¹Colorado State University.

On eight non-consecutive days, 192 Hereford x Charolais heifers were restrained in a scissors type, hydraulic squeeze chute. Squeeze chute temperament and balking behavior was scored with 4-point scales. Squeeze chute temperament scores were 1= calm, stood still, 2 = struggled once, 3 = struggled multiple times, flexed shoulder muscles, and 4 = violent and consistent struggling. Balking behavior at the squeeze chute entrance was 1= entered chute without hesitation, 2 = Hesitation, moved into chute after being touched, 3 = Hesitated, tail twisted, and 4 = electric prod used. Gentle and quiet handling was maintained during all handling of the cattle, for all days. Squeeze chute and balking scores decreased with repetitive handling ($P<.01$). Mean squeeze chute score was reduced from 1.94 to 1.39 during the eight days. Balking before entering the squeeze chute was reduced from a mean of 1.89 on day one to a mean of 1.58 on day eight. Heifers with higher temperament scores typically entered the squeeze chute last ($R^2=.84$, $P<.01$). Gentle, repetitive handling of cattle decreases balking in the handling facility and decreases reactivity to restraint in a squeeze chute. Cattle became easier to move into the squeeze chute with each successive handling.

Key Words: Cattle, Behavior, Temperament

1145 Genetic determination of maintenance behavior of calves. Jan J.J. Broucek^{*1}, Ted H. Friend², Clive W. Arave³, Paul Flak¹, Stefan Mihina¹, Michael Uhrincat¹, Anton Hanus¹, and Peter Kisac¹, ¹Research Institute of Animal Production, Nitra, Slovakia, ²Texas A&M University, College Station, USA, ³Utah State University, Logan, USA.

We assessed 21 Holstein calves (12 males and 9 females) descended from 3 bulls (AMS1, n=6; STB9, n=8; PEL2, n=7). The calves were kept in loose housing. We conducted three observations of maintenance behaviour, at 14 (A1), 16 (A2) and 19 (A3) weeks of age. The general activity of each of the animals was recorded at 10 min intervals over 24 hours. A significant effect of sire was found in the number of standing bouts (AMS1=36; STB9=38; PEL2=40, $P<.05$); a significant effect of gender in the time of lying (832 min males vs 802 min females, $P<.05$) and standing (608 min males vs 638 min females, $P<.05$), in the number of bouts when lying on the right side (20.1 males vs 18 females, $P<.05$) and standing (37.6 males vs 39.3 females, $P<.05$). The effect of age was highly significant in the time spent lying (A1=750 min; A2=826 min; A3=881 min, $P<.01$), in the time spent lying while ruminating (A1=325 min; A2=416 min; A3=450 min, $P<.01$), in the time of lying on the right side with rumination (A1=136.7 min; A2=157.6 min; A3=172.4 min, $P<.01$), in the time of standing (A1=690 min; A2=613 min; A3=559 min, $P<.01$), ruminating (A1=336 min; A2=442 min; A3=475 min, $P<.01$) and feeding (A1=289 min; A2=397 min; A3=327 min, $P<.01$), in the number of bouts lying while ruminating (A1=12.4; A2=15.8; A3=16.3, $P<.01$), number of bouts lying on the left side with rumination (A1=6.6; A2=8.8; A3=9, $P<.01$) and in the number of ruminating periods (A1=13.9; A2=18; A3=18.7, $P<.01$). A significant effect of age was found in the number of lying bouts on the right side (A1=17; A2=20.6; A3=20, $P<.05$). Significant interactions for sire x gender were found in the number of standing bouts ($P<.05$),

sire x age in the time of standing ($P < .05$), time of lying while ruminating ($P < .05$) and in the number of lying bouts on the right side ($P < .01$), and gender x age in the number of standing periods ($P < .01$). The results show that females stood more. Times spent lying, ruminating and feeding were increasing with the age, similar as the number of bouts lying while ruminating, lying on the left side with rumination, ruminating and lying bouts on the right side. We concluded from the analysis, that the effect of the sires' genotype was manifested only in the number of standing bouts.

Key Words: Calves, Behaviour, Sire

1146 Feeding behavior of lactating dairy cows as measured by real-time control system. Zadok Shabi^{*1}, Michael Murphy¹, and Uzi Moallem², ¹University of Illinois, ²A.R.O, The Volcani Center, Israel.

To increase milk production various management schemes are used by dairy producers. These include increase feeding-frequencies, cooling system, more milking per day, artificial lighting, processing of feedstuffs, and manipulating the diet composition. Using one of these management tools or combination of two or more might affect eating behavior. The effect of most of these management tools on daily eating behavior pattern is not yet known. Dairy producers can use knowledge of animal behaviour to improve cow well being and performance. A real-time control system for individual food intake of group-housed lactating dairy cows was used to evaluate feeding behavior. The system consists of 40 feeding stations, one for each cow. Each station equipped with individual identification system, on line scale and logic controller. These systems enabled measurement and recording for each visit the date, entrance time, exit time, and food consumed. Later, daily food consumption, number of visits, meal duration, and rate of food intake were calculated from the recorded database. The average daily intake was 36.0 kg as fed /d, time spent eating was 170.3 min/cow/d, and 12.0 visits daily. A statistic model, which combines two normal curves, was fitted to data from 2 mo during the summer. The bi-normal model explained more than 91.0% of variation in feeding behavior ($P < 0.01$). The first peak was at 0814 (mean sunrise 0508) with a CV of 24.0%. The second peak was at 1634 (mean sunset 1818) with a CV of 6.4%. The later the second peak in feed consumption, the more visits cows made to the feeder ($r = .363$, $P < 0.02$). The broader the second peak in feed consumption, the more total feed was consumed ($r = .378$, $P < 0.03$). On average, 61% of the total intake was associated with the first peak. These results have likely implications for scheduling milking and feeding times to maximize intake and production.

Key Words: Feeding behavior, Dairy cows

1147 Behavioral and physiological responses of calves to dehorning using a long acting local anesthetic. J. W. Forehand^{*1}, H. G. Kattesh¹, T. J. Doherty¹, M. G. Welborn¹, A. M. Saxton¹, J. L. Morrow², and J. W. Dailey², ¹University of Tennessee, Knoxville TN, ²ARS-USDA, Lubbock, TX.

Behavioral and physiological responses after dehorning by heat cauterization were measured in 32, 10 to 12-wk old female Holstein calves. Each calf was randomly allotted to one of four treatments; 5% lidocaine followed by dehorning (F), 2% lidocaine followed by dehorning (T), saline followed by dehorning (S), or 5% lidocaine followed by sham dehorning (C). Physiological responses were assessed by collecting blood via a jugular catheter at -0.5, 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 6, 9, 12, 24, 48, and 72 h. Feeding, drinking, scratching, grooming, rubbing, licking, and inactivity behaviors were observed in the standing and recumbent positions using a 10-min scan sampling method and analyzed on a time period and daily basis for 72 h following the procedure. Acute phase proteins and immunological components were determined at 0, 12, 24, 48, and 72 h. Plasma cortisol was not affected by treatment ($P = .07$) or treatment by time interaction ($P = .06$), but there was an overall significant ($P < .001$) time effect. Calves showed an immediate increase in cortisol within the first 0.5h (9.3 ± 1.1 vs. 18.8 ± 2.2 ng/mL) and again from the 4 h to 6 h samples (5.7 ± 1.4 vs. 10.4 ± 1.3 ng/mL). Fibrinogen concentration and neutrophil:lymphocyte (N:L) ratio were not altered ($P > .1$) by treatment. However, N:L was highest ($P < .01$) at 12 h. For the first 24 h post-dehorning, behaviors of all calves were similar and frequencies of scratching, licking, grooming, and head rubbing in the recumbent and standing positions were near zero. Treatment differences in recumbent inactivity were not significant ($P = .09$),

but there was an overall increase in inactivity for all groups over time ($P < .001$). Eating and drinking frequency were not affected ($P > .05$) by treatment. Thus, behavioral and physiological responses following dehorning by heat cauterization do not appear to be different in calves with or without prior administration of 2 or 5% lidocaine.

Key Words: Dehorning, Behavior, Anesthesia

1148 The effects of management stressors on cortisol production in various breeds of bulls. J.W. Koch^{*1,2}, S.R. Tatman¹, D.A. Nueundorff¹, T.W. Wilson¹, A.W. Lewis¹, C.C. Chase³, T.H. Welsh², and R.D. Randel¹, ¹Texas Agricultural Experiment Station, Overton, TX, ²College Station, TX, ³ARS, USDA, Brooksville, FL.

Beef management practices may induce stress responses in cattle. The influence of breed on response to transportation and restraint was studied using Angus ($n=7$, A), Bonsmara ($n=8$, BO), Brahman ($n=8$, BR), Romosinuano ($n=10$, R), Tuli ($n=10$, T) and Wagyu ($n=10$, W) bulls. Blood samples were obtained by tail venipuncture [5 min prior to and post transportation (30min, 18mile)] and by jugular cannula every 15 min for 6 h. Pre-transportation plasma cortisol did not differ among breeds (13.9 ± 3.5 , A; 4.5 ± 3.5 , BO; 12.6 ± 3.2 , BR; 9.5 ± 3.0 , R; 8.0 ± 3.0 , T; 5.2 ± 3.2 , W ng/ml, respectively). BR, R, A, and T had similar post-trailer cortisol concentrations (26.3 ± 4.0 , 24.3 ± 3.8 , 18.5 ± 4.4 , 17.1 ± 3.8 , respectively). However these values exceeded ($P < .02$) that of the BO (2.4 ± 4.4) bulls which was similar ($P > .22$) to the W (9.7 ± 4.0) bulls. Post-trailer cortisol did not differ among A, T and W bulls. R, BR and T had similar change of post-trailer and pre-trailer cortisol concentrations (14.8 ± 3.4 , 13.6 ± 3.6 , 9.1 ± 3.4 ng/ml), but greater ($P < .04$) than that of the BO (-2.1 ± 3.9). The R (14.8 ± 3.4) differed ($P < .05$) from the A and W (4.6 ± 3.9 , 4.5 ± 3.6) which were similar ($P > .08$) to that of the BO, T and BR (-2.1 ± 3.9 , 9.1 ± 3.4 , 13.6 ± 3.6). There was a breed difference ($P < .05$) for cortisol concentrations for the first two hours, but no difference for the second two or third two hours. The average plasma cortisol concentrations for all samples during the 6-h period, average cortisol for the middle two and last two hours and lowest cortisol concentration for the six h window did not differ ($P > .13$). BR, A, R and T had similar highest mean cortisol concentrations (25.7 ± 3.8 ; 25.5 ± 4.4 ; 22.5 ± 3.4 ; 21.1 ± 3.4 , respectively). BO and W had similar highest mean cortisol concentrations (12.9 ± 3.8 ; 12.6 ± 3.4), but this was lower than that of BR, A and R bulls. Various breeds of bulls respond differently to normal management stressors.

Key Words: Bulls, Transportation, Restraint

1149 Effects of cooling strategies on physiological responses to heat challenge. K. M. Spurlin^{*}, D. E. Spiers, M. Ellersieck, and J. N. Spain, University of Missouri - Columbia.

An environmental chamber study was designed to evaluate physiological responses initiated at various levels of heat stress with particular interest in digestive function. Thermal status measurements are summarized. Four fistulated cows were used to compare 4 cooling strategies. Treatments were 24 h (24h; continuous fan cooling), 12 h nighttime (12N; fans on between 1900 and 0700), 12 h daytime (12D; fans on between 0700 and 1900), and no cooling (NO). Treatments were administered during consecutive 14-d periods arranged as a 4x4 Latin Square. Cows were housed in a climate-controlled room during the experiment. Periods included 6 d thermoneutral (20 C), 3 d step-up, followed by 5 d heat challenge. During heat challenge, maximum ambient temperature reached 32 C between 1400 to 1800 and was lowered to 22 C from 0200 to 0600. On d 6 to 14, respiration rates (RR), skin temperatures at the tailhead (TT), rump (RuT), and shoulder (ST), as well as rectal temperatures (ReT) were recorded at 0500, 1000, 1500, 1900, and 2200 h. There were no treatment effects ($P=0.28$) for ReT; however, there was a trend toward significance for RR and TT ($P=.16$ and $P=.11$, respectively). These responses indicate animals were able to effectively respond to the thermal challenge. Mean RuT temps were 33.4, 33.7, 33.8, and 33.8C for 24h, 12N, 12D, and NO, respectively. RuT for the 24h group was lower than that of all other groups ($P < .05$); RuT for the 12N group tended ($P=.06$) to be lower than that for the NO group. Least square means for SS temperatures were 33.0, 33.2, 33.6, and 33.7 C for 24h, 12N, 12D, and NO, respectively. Both 24h and 12N ST were different ($P < .05$) from each other and the other 2 groups. A treatment by time interaction ($P < .05$) was only observed for ST measurements. All measurements had significant ($P < .05$) day, time, and day by time

effects. Animal responses indicate that the minimum nighttime temperature was low enough to allow sufficient heat loss to cool at night without fans. Regardless of cooling strategy, animals maintained thermal balance through effective thermoregulatory responses during the 5 d heat challenge.

Key Words: Heat stress, Thermal status, Cooling

1150 Evaluation of a model to predict internal body temperature in feedlot cattle during summer heat. L. E. McVicker*, M. J. Leonard, and D. E. Spiers, *University of Missouri, Columbia, MO.*

Exposure of feedlot cattle to summer heat in the absence of shade results in reduced overall performance. A 12-day field study was conducted in year 2000 to refine a predictive model of core temperature by comparison with our 1999 model. Angus x Simmental steers (445+/-9 kg; n=24) were kept in unshaded feedlot pens, and provided with a typical finishing diet and water *ad libitum*. Implanted telemetric temperature transmitters (CowTemp, Model BV-010) were placed in the peritoneal cavity (T_{core}) and rumen (T_{rm}) in years 1999 and 2000, respectively, to continuously monitor core temperature. Data loggers (Onset "Hobo") recorded ambient conditions, including percent relative humidity, air temperature (T_a), and black globe temperature (BG) to identify radiant heat load. Both temperature-humidity (THI) and black globe temperature-humidity (BGTHI) indices were calculated using these values. Initial comparisons showed that T_{rm} was 0.6°C higher than T_{core} at non-heat stress T_a of 25°C or less, with a gradual reduction to 0.3°C at 35°C. Temperature of both sites reached lowest level at 0700 and highest within 1-2 h of daily maximum T_a . Further analyses used only day values. Highest correlation coefficients for prediction of T_{core} (1999) were obtained with T_a x BG ($r = .90$; $P < .001$) and THI x BGTHI ($r = .89$; $P < .001$) values that preceded T_{core} by 1 h. In 2000, highest correlation coefficients for prediction of T_{rm} utilized THI x BGTHI ($r = .84$; $P < .001$) and T_a x BG ($r = .81$; $P < .001$) values at 3 h before T_{rm} . A second-order polynomial expression best described these relationships with only a 1-2 h delay. However, comparable correlations at a 3 h delay required only a linear expression. Changes in thermal status of cattle in a feedlot environment can be predicted using the combination of air and black globe temperature inputs. Predictive success is improved with inclusion of time delays of 1-3 h. Separate predictive equations for internal temperature must be developed for different core regions.

Key Words: Heat Stress, Models, Cattle

1151 Effects of simulated preslaughter holding and isolation on stress responses and live weight shrinkage in goats. G. Kannan*, T. H. Terrill, B. Kouakou, S. Miller, S. Gelaye, and E. A. Amoah, *Agricultural Research Station, Fort Valley State University, Fort Valley, GA.*

The objective of this experiment was to determine the effects of preslaughter feed withdrawal duration and isolation on physiological responses and shrinkage in goats. A total of 84 Spanish does (6 mo of age, average weight 35 kg) were individually weighed and scored for excitability before the two replicate (day) trials. The does were feed deprived (FD) or fed (F) in holding pens (treatment, TRT) for either 0, 7, 14, or 21 h (TIME). At the end of the holding periods, FD and F does were blood sampled ($n = 6$ does/treatment/time/replicate) and weighed again to assess physiological responses and shrinkage. Individual does from each pen were then subjected to one of three handling post-treatments (PTRT): a 15-min isolation with no visual contact with other does (I); a 15-min isolation with visual contact (IV); or no isolation (C, control). Blood samples were collected again after imposing PTRT. The data were analyzed as Split-Unit designs using MIXED procedures in SAS. Plasma cortisol concentrations were influenced by TIME ($P < 0.01$), but not by TRT when measured after the holding periods. Plasma T3, T4, and leptin concentrations, and differential leukocyte counts (neutrophil, lymphocyte, eosinophil, monocyte) were not influenced by any of the factors. Excitability scores did not have any significant effect on the variables measured. Shrinkage increased with increasing holding time ($P < 0.01$), but more prominently in the FD group (TRT x TIME, $P < 0.01$). The FD group also had greater shrinkage than the F group ($P < 0.01$). Plasma cortisol concentrations were greater in I and IV groups than in the C group ($P < 0.01$). The results

indicate that the novelty of environment during preslaughter holding may be a more potent stressor than feed deprivation in goats, although shrinkage may increase with increasing feed withdrawal times. Stress can significantly increase when animals go through the isolation chutes just prior to slaughter.

Key Words: Goats, Preslaughter holding, Isolation stress

1152 Effect of animal handling method on the incidence of stress response in market swine in a model system. M. E. Benjamin*¹, H. W. Gonyou², D. J. Ivers³, L. F. Richardson³, D. J. Jones³, J. R. Wagner³, R. Seneriz³, and D. B. Anderson³, ¹Elanco/Provel Animal Health, Calgary, Canada, ²Prairie Swine Centre, Saskatoon, SK, Canada, ³Elanco Animal Health, Greenfield, Indiana.

The relationship between aggressive handling of lean pigs, including the use of an electric prod, and subsequent behavioral and physiological responses was studied to develop methods for simulating conditions which may result in non-ambulatory (SUBJECT) pigs at slaughter plants. One-hundred eight barrows and gilts weighing approximately 120 kg were randomly assigned to groups of six for moving, loading and unloading in one of two handling treatments. In the aggressive handling treatment (AGGRESS), the handler moved the animals through a 300 m course, including a high loading ramp, with frequent use of an electric prod. In the gentle handling treatment (GENTLE), the handler proceeded at a moderate pace through the same course, except that the loading ramp was lower and a plastic cane was used in place of the prod. Groups were treated consecutively to avoid circadian and ambient temperature bias. The handler and pig behavior were documented using direct observation. The same handler conducted both treatments. Serum lactate, glucose, NEFA, CPK, BUN, ammonia, acetate and cortisol were measured immediately after handling. Heart rate (HR) and skin and rectal body temperatures (sTEMP, rTEMP) were measured pre, during and post handling. Subjective scores were recorded for indications of blotchy skin (SKIN), open mouth breathing (BREATH) and vocalization (VOCAL). Pigs wedged (STUCK) during handling were recorded as well as the dependent behavior SUBJECT (inability to move, higher rTEMP, blotchy skin). This study suggests that the AGGRESS treatment resulted in a significant increase in SKIN, BREATH and VOCAL during each of the observation points ($P < 0.001$). Analysis of pen means demonstrated a significant association between AGGRESS treatment and dependent variables sTEMP, rTEMP and HR. Serum lactate and glucose were higher ($P < 0.005$) in the AGGRESS treatment group. While eleven pigs were classified as SUBJECT pigs in AGGRESS, none were found in GENTLE. When individual SUBJECT pigs were compared with the remaining pigs of AGGRESS there were significant positive associations with dependent variables ammonia ($P < 0.05$) and STUCK ($P < 0.05$). The behavioral and physiological responses of the pigs provide strong indicators of the stress induced by aggressive handling.

Key Words: Swine, Handling, Subject animals

1153 Variation in Hen Vocalizations During Pre-hatch, Hatch and Post-Hatch. M.B. Woodcock*, M.A. Latour, and E.A. Pajor, *Purdue University, West Lafayette, IN 47907.*

Vocalizations between hens and chicks around the time of hatch are commonly reported for poultry kept in natural conditions. Commercial incubators do not presently include such sounds, which may result in a more asynchronous hatch than under natural conditions. Before this hypothesis can be tested a better understanding of the hens calls, and their function is required. Although the occurrence of vocalizations around the hatch has been previously reported, details regarding the frequency and duration of hen calls have not. The purpose of this study was to describe in detail the pattern of a hen's vocalizations around a natural hatch. Four hens were placed in pens and audio and videotaped each day, during a 16 h light period (0400 to 2000 h), for 30 d (20 d before hatch and 10 d after hatch). Hen vocalizations were quantified in detail during three periods: pre-hatch (48 h before hatch), hatch (0 to 24 h), and post-hatch (48 h after hatch). Of the 4 hens, only two hens became broody and vocalized. Hens vocalized less at pre-hatch than during the hatch ($p < 0.001$) or post-hatch ($p < 0.001$). The average call rates on the day of hatch and post-hatch did not differ. However, the daily

pattern of calls differed greatly. On the day of hatch, calling rate gradually increased over the 16 h period. In contrast, during the post-hatch period, hen calls increased quickly during the first nine h, and then declined dramatically. The amount of time spent calling changed over the duration of the 16 h period. Hens spent more time calling at hatch than pre-hatch ($p < 0.001$), and more time calling in post-hatch than hatch ($p < 0.05$). In summary, the hens called more and spent more time calling as incubation progressed through hatch. A better understanding of parent - offspring communication during hatching may lead to beneficial applications to the commercial poultry industry.

Key Words: Poultry, Vocalization, Incubation

1154 The relationship between physiological parameters and behavioral response to social stress among three genetic lines of laying hens. R. Freire^{*2}, P. Singleton¹, Y. Chen¹, M.W. Muir², Ed. Pajor², and H.W. Cheng¹, ¹USDA-ARS, Livestock Behavior Research Unit, ²Dept of Animal Science, Purdue University.

Two genetic lines of White Leghorn hens have been selected for high (HGPS) and low (LGPS) group productivity and survivability resulting from cannibalism and flightiness. Different behavioral patterns induced by heat and cold stress have been reported between the selected HGPS line and a commercial Dekalb XL (DXL) line. The aim of this study was to examine differences in the behavioral response to social stress among the three genetic lines and relate these differences to physiological variables that were reported previously. Twenty hens from each of the three genetic lines were paired to form 3 mixed line combinations and kept in cages from 17-wk to 24-wk of age. Activities were recorded from video using instantaneous sampling at 1-min intervals for 30 min and continuous recording of aggressive pecking in a 10 min period started at 0800 daily. No evidence was found that the three genetic lines differed in dominance status ($P > 0.1$ for 3 combinations) or attack latencies ($P > 0.7$). The HGPS hens spent less time pecking at the feathers or body of another hen (damaging pecking) than LGPS hens ($P < 0.05$). In addition, pecking at the cage (cage pecking) was lower in HGPS and LGPS hens than in DXL hens ($P < 0.01$). The differences in damaging pecking could not be explained by variation in physiological variables ($P > 0.2$), but a large proportion of the variation in cage pecking ($r^2=59\%$) among the lines ($P < 0.001$) was explained by physiological variables, such as its unique alterations of heterophil/lymphocyte (H/L) ratio and corticosterone levels reported previously. In conclusion, the lower damaging pecking and cage pecking in HGPS hens may be related to their

lower social stress in 2-hen cages when compared to the other two lines. The data suggests that the genetic lines could be used as animal models for stress physiological observations.

Key Words: Social stress, behavior, Genetic selection, chickens.

1155 Stress induced alterations of IgG concentrations and hematological parameters in genetically selected chicken lines. Y. Chen^{*1}, P. Singleton¹, M.W. Muir², and H.W. Cheng¹, ¹USDA-ARS, Livestock Behavior Research Unit, ²Dept of Animal Science, Purdue University.

Two genetic lines of White Leghorn hens were selected for high (HGPS) and low (LGPS) group productivity and survivability resulting from cannibalism and flightiness. The aim of this study was to examine whether the selection alters the hens' immunity and hematology differently in response to social stress. At 17-wk of age, hens were randomly assigned into single- and 2-hen cages. The 2-hen cages contained one hen from HGPS or LGPS and one from a commercial Dekalb XL line that was used as standardized genetic competitor. At 24-wk of age, blood samples were collected from 70 hens (10 hens from 3 line, 2 replicates, plus 10 extra testers). Blood smears were prepared and stained with Wright's stains. A differential leucocyte count was collected from 200 leukocytes per hen. Concentrations of plasma IgG were quantified using ELISA. In single-hen cages, compared to HGPS hens, LGPS hens had a greater heterophil/lymphocyte (H/L) ratio ($P < 0.01$). In addition, LGPS hens had a greater number of eosinophils ($P < 0.01$). However, there was no difference in the concentrations of IgG between HGPS and LGPS hens. In 2-hen cages, when compared with these same lines in the single-hen status, LGPS hens exhibited a heterophilia, and a greater ratio of H/L ($P < 0.01$). In addition, although both HGPS and LGPS hens had an eosinophilia in 2-hen cages, a more intense increase was found in LGPS hens ($P < 0.001$). In contrast, HGPS hens had a greater increase in the concentrations of IgG in 2-hen cages vs. single-hen cages ($P < 0.01$). The data indicates that the immunity and hematology were differently regulated by the selection in the HGPS and LGPS lines. The changes of these physiological parameters in HGPS hens could be associated with their better adaptation to social stress that has been reported previously. Some of the parameters, such as ratio of H/L, eosinophilia, and IgG concentrations, could be used as an indicator of chicken well-being.

Key Words: Social stress, Plasma IgG and hematological parameters, Genetic selection, chickens.

ASAS/ADSA Ruminant Nutrition: Feed Additives, Rumen Fermentation, Minerals, and Transition Cows

1156 Use of exogenous enzymes from amylases from *Bacillus licheniformis* and *Aspergillus niger* in high-grain diets. R Rojo, G Mendoza*, S Gonzalez, R Barcena, M Crosby, and L Landois, Colegio de Postgraduados.

Two industrial amylases, alpha-amylase from *Bacillus licheniformis* and glucoamylase from *Aspergillus niger* were evaluated as exogenous enzymes in sheep fed high-grain diets. Amylolytic activity was compared with ruminal amylases at conditions of pH and temperature similar to the rumen. In situ DM digestibility of sorghum diets (79%) was measured at 12 h of ruminal incubation. Amylases were added to the sorghum (2.9 g enzyme/kg grain) before mixing the diet. Fifteen sheep were used in a completely randomized design (control, amylase or glucoamylase) and individually fed for 40 d. The highest activity (units/mg protein) was found ($P<0.01$) in the amylase from *B. licheniformis* (4.1893) followed by the *A. niger* (1.9522) and ruminal fluid (0.0621). Addition of alpha-amylases increased in situ DM digestibility (%) at 12 h (control, 60.78), being greater with *B. licheniformis* (65.6) than *A. niger* (64.3). Intake was not affected by enzyme addition and no statistical differences were found in ADG (Control 238, *A. niger* 258, *B. licheniformis* 270 g/d), even when feed conversion numerically tended to be improved with the amylases (Control 4.59, *A. niger* 4.01, *B. licheniformis* 3.93 g/d). Despite the high amylolytic activity of the amylases and the improvements on in situ DM digestibility, no differences were detected in sheep performance.

Key Words: Enzymes, Grains, Starch

1157 Effect of direct-fed microbials supplementation on dairy cows fed nitrogen deficient diets and on *in vitro* bacterial growth. D. R. Ouellet* and J. Chiquette, Dairy and Swine R&D Centre, Agriculture and Agri-Food Canada, Lennoxville, Canada.

Eight rumen fistulated Holstein dairy cows (679 kg BW; SEM = 5) were used in a duplicated 4 x 4 Latin square design with a 2 x 2 factorial arrangement of treatments. Dairy cows were fed diets formulated to be adequate (CTL) or deficient (DEF) in metabolizable protein (MP; 12% less than requirements). The two diets were fed with or without direct-fed microbials (DFM) supplement (10 g /head/d of a mixture of *Aspergillus oryzae* and *Saccharomyces cerevisiae*). Total mixed ration (60:40 grass silage:barley based concentrate) was fed 12 times daily. Dry matter intake, milk production and composition were determined. The DFM mixture was also supplied, *in vitro*, to pure bacterial cultures in order to study the effect on bacterial growth rate. Given the high milk yield, both diets were estimated (NRC, 2001) to be deficient (10 and 14% less MP than requirements for CTL and DEF, respectively). Milk production averaged 40.3 kg/d and was not affected by the level of MP in the diets or by DFM. Dry matter intake tended to be lower for cows fed DEF (21.2 vs 22.9 kg/d, $P < 0.07$) resulting in a tendency ($P < 0.09$) to improve milk efficiency by 9%. Milk constituents (protein, fat and lactose) were unaffected by treatments. When supplied *in vitro*, the DFM mixture stimulated the growth of *Selenomonas ruminantium* ($P < 0.001$), *Streptococcus bovis* ($P < 0.02$) as well as some cellulolytic species such as *Butyrivibrio fibrisolvens* ($P < 0.02$) and *Fibrobacter succinogenes* ($P < 0.01$). On the other hand, DFM did not