

**433 Temperament alters adrenal response to exogenous ACTH in Brahman heifers.** K. O. Curley, Jr.<sup>1,2</sup>, D. A. Neuendorff<sup>2</sup>, A. W. Lewis<sup>2</sup>, J. J. Cleere<sup>2</sup>, T. H. Welsh, Jr.<sup>1</sup>, and R. D. Randel<sup>2</sup>, <sup>1</sup>Texas Agricultural Experiment Station, College Station, <sup>2</sup>Texas Agricultural Experiment Station, Overton.

The objective of this study was to compare adrenal responsiveness to stimulation with exogenous ACTH, in calm and temperamental heifers. Two-year old, spring born Brahman heifers comprised the two temperament groups that were selected using exit velocity (EV). The calm (C) and temperamental (T) groups consisted of the 6 slowest (EV=1.05±.05 m/sec) and 6 fastest (EV=3.14±0.22 m/sec) two-year old heifers within the herd. Blood samples were collected via indwelling jugular cannula for 6h pre- and 6h post- administration of ACTH (0.1 IU/kg BW). Sampling intervals were 15min throughout the 12h except for the final 180min; when the sampling intervals were 30min. Serum cortisol (CS) concentrations were determined via RIA. Pearson correlation coefficients and ANOVA were used for statistical comparisons. Basal CS, determined as the mean concentration (ng/mL) within the 1h period prior

to ACTH challenge, was correlated to EV (r=.87; P<.001) and differed (P<.001) between temperament groups (C=4.5±.7 and T=18.7±2.9). Following ACTH challenge, both peak CS and time to reach peak CS did not differ between temperament groups. Temperament influenced (P<.001) the increase, induced by the ACTH challenge, from basal CS (C=1375±215 and T=310±94%). A negative correlation was found between EV and % increase in CS (r=-.83; P<.001) increase. Time to return to basal CS was also influenced (P<.001) by temperament group as C took longer than T heifers (C=268±10 and T=154±18min). The area under the curve following the return to basal CS was not influenced by temperament (C=7548±644 and T=8464±428ng\*min/mL), indicating that the CS concentrations in the temperamental heifers continued to decrease below basal concentrations. As poor temperament relates to increased basal adrenal activity and muted responsiveness to pharmacological stimulus, temperament does affect stress mechanisms. Exit velocity can be used as an indicator of temperament and predictor of adrenal response to ACTH.

**Key Words:** Temperament, ACTH Challenge, Exit Velocity

## PSA - Environment and Management: Layer Management

**434 The impact of layer dietary threonine levels on egg component yield, composition, and functionality.** P. R. Niemeier\*, C. D. Coufal, and J. B. Carey, Texas A&M University, College Station.

Over 20 weeks, one hundred 35 week old Single Comb White Leghorn laying hens were housed individually in an open sided laying facility with groups of 5 hens sharing access to a common feed trough. A typical layer diet (diet A) containing 0.56% threonine was fed to control hens. Four experimental diets containing additional levels of threonine were fed for 18 weeks. Diets B, C, D, E, contained threonine at levels of 0.66%, 0.76%, 0.86%, and 0.96% respectively. Egg samples were analyzed for egg weight, shell strength, and yolk and albumen yield, protein content, solids, and functionality. Albumen and yolk were kept separate and pooled by nutritional treatment, homogenized and analyzed for protein content and solids. Eggs were sampled at weeks 3, 10, and 16 for angel and sponge cake. Yolk and albumen were separated and pooled by nutritional treatment to make three replicates each of sponge and angel food cakes. Results were recorded by rapeseed displacement. Cake samples were cored, five cores per cake and subjected to double compression on the Instron Universal Testing machine. Cakes were measured for hardness, cohesiveness, springiness, gumminess, and chewiness. Yolk protein content was found to be significantly higher in diets C, D, and E, when compared to diets A and B. Yolk solids showed no significant differences over the dietary treatments. Sponge cake rapeseed displacement yielded no differences among diets. Albumen protein content was found to be significant higher in diets C and E when compared to the other diets. Diet E was found to have significantly higher albumen solids and angel cake rapeseed displacement when compared to the other dietary treatments. These data clearly indicate a potentially important impact of threonine nutrition of laying hens on LE yield, composition, and functionality.

**Key Words:** Threonine, Liquid Eggs, Egg Composition

**435 Single and combined effects of yeast cell wall residue and Sel-Plex® on production and egg quality of laying hens.** V. G. Stanley\*<sup>1</sup>, W. F. Krueger<sup>2</sup>, and A. E. Sefton<sup>3</sup>, <sup>1</sup>Prairie View A&M University, Prairie View, <sup>2</sup>Texas A&M University, College Station, <sup>3</sup>Alltech, Guelph, ON, Canada.

The objectives of the study were to examine the effects of yeast cell wall residue (Bio-Mos) and Sel-Plex, single and combined on egg production and egg quality from 37-wk-old White Leghorn hens for 4 wk in a completely randomized designed experiment. Hens were reared in cages, 2 hens per cage, and fed the same corn-soybean based layer diet, supplemented with either Bio-Mos (2 kg/ton) or Sel-Plex (1 lb/kg) and combined with 16% CP, 2,800 kcal ME/kg, 3.5% Ca and .6% P. Hen-day egg production from the Sel-Plex-fed hens was significantly higher (P<.05) than the control (88 vs 81%) and Bio-Mos (83.2%). Egg production of the Bio-Mos plus Sel-Plex-fed hens was also significantly higher (90%) than the control (81.4%). Eggs from the Sel-Plex-fed hens weighed significantly more (68.13 g), had heavier yolks (31.9 g) and albumen (59.8 g), compared to the control [63.20%, 18.12 g (28.7%),

and 35.03 g (55.4%), respectively]. Sel-Plex plus Bio-Mos-fed hens produced yolk (20.68 g) and albumen (39.02 g) significantly heavier than control (18.12% and 35.51%, respectively). Eggs from the Bio-Mos-fed hens were significantly heavier than the control (65.41g vs 63.21g). However, yolk and albumen weights from the Bio-Mos-fed hens [19.42g (29.7%) and 35.91g(54.9%), respectively] did not differ significantly from the control [18.12g (28.7%) and 35.51g (56.2%), respectively]. Hens fed Bio-Mos supplemented-feed had significantly larger eggs (65.41g), yolk [19.38 g (29.6%)] and albumen weight [35.93g (54.93%)] compared to the control [63.14g, 18.07g (28.62%), 35.47g (56.18%), respectively]. Cholesterol concentration per gram of whole egg was significantly lower for the Sel-Plex-fed hens (193.2 mg/dL) compared to the control (236.1 mg/dL). Egg cholesterol concentration from the Bio-Mos plus Sel-Plex-fed hens was also significantly lower (211.2 mg/dL) than the control (236.1 mg/dL). The results suggested that Sel-Plex had beneficial effects on egg production, egg size, and egg cholesterol concentration and there appears to be a synergistic effect of Bio-Mos and Sel-Plex on egg production.

**Key Words:** Sel-Plex, Bio-Mos, Laying hens

**436 Beak trimming of Leghorn pullets 2: Healing and beak re-growth.** C. B. Annett\*, K. Schwean-Lardner, and H. L. Classen, Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada.

Beak trimming of White Leghorn pullets is performed in an attempt to reduce cannibalism and improve performance in the flock. This procedure, when optimally performed, removes the rostral portion of the beak, including the epidermis, innervated and vascularized dermis and bone of the maxilla and mandible. The objective of this study was to observe histological healing and neuroma formation and measure re-growth of beaks from two strains of pullets that had been beak trimmed at the hatchery, or trimmed on farm at 10d or 35d of age. Six beaks (2 trimmed of each strain and 1 each of untrimmed) were collected at 1d, 10d, 30d and 210d post trim and placed in 10% buffered formalin. Following fixation, beaks were trimmed sagittally and the medial aspect trimmed to 3-5 mm, mounted and stained with haematoxylin & eosin for histological examination. Healing was rated on a graded scale of 1 (no healing) to 7 (no lesions). At 2d, 86d and 43 wk of age, Vernier calipers were used to measure beak length from the rostral nares to the beak tip in 40 birds per treatment per strain. Data were analyzed as a 2 X 4 factorial analysis, with Duncans Multiple Range Test separating means when ANOVA was significant. No healing was seen in any of the treatment groups at 1d post trim. At 10d post-trim, beaks of pullets trimmed at the hatchery had a significantly improved healing score (4.25) compared to pullets that had been beak trimmed at 10d (1.25) and 35d (1.00) of age, however, by 30d post-trim healing between groups was not different (5.75, 5.50 and 5.00, respectively). Beaks were considered healed at 210d post-trim (6.00, 6.00, 6.00). Neuromas were not identified in any of the beaks examined. There were significant differences in beak length between all groups (untrimmed: 17.7 mm; 0d: 13.5 mm; 10d: 11.7; and 35d: 16.1mm) when measured at 43 wk of

age. In conclusion, there is faster healing and less re-growth of beaks when pullets are beak-trimmed at 0d or 10d of age compared to pullets beak-trimmed at 35d of age.

**Key Words:** Beak Trimming, Neuroma, Age

**437 Ammonia emissions of commercial broilers from 0-42 days of age.** L. Mitran\*<sup>1</sup>, J. Harter-Dennis<sup>1</sup>, J. Meisinger<sup>2</sup>, and J. Timmons<sup>1</sup>, *Department of Agriculture and Natural Sciences, University of Maryland Eastern Shore, Princess Anne, <sup>2</sup>USDA-ARS.*

An experiment was conducted to quantify the rate of ammonia (NH<sub>3</sub>) emission from commercial broilers. This research is a part of a larger project to determine the total N budget of broilers. Six environmentally controlled chambers (37.2 m<sup>2</sup>) equipped with automatic feeding and watering systems were used. Pooled used wood shaving/sawdust litter was thoroughly mixed, weighed and equally distributed into the chambers. Five hundred one-day old birds (250 males, 250 females) were placed per chamber and raised for 42 days. Samples of litter, feed and birds were collected at the beginning, the end and at every feed change during the trial to determine the nitrogen content. A known percentage of the exhausted air was circulated through a weak acid solution to collect ammonia which was later determined using a QuikChem<sup>®</sup> 8000 Automated Ion Analyzer (QuikChem<sup>®</sup> Method 10-107-06-2-J). Ventilation rates were accurately estimated using an Alnor Electronic Balometer. Mean daily ammonia emissions ranged from 0.13 to 0.77g (NH<sub>3</sub>-N)/b/d, with a mean of 0.36g NH<sub>3</sub>-N/b/d and a coefficient of variation (CV) of 7.6%. Ammonia emissions were relatively constant (<.25 g/b/d) during the early growth period (0-17 days) followed by a linear increase from 18-42 days of age. The majority of NH<sub>3</sub>-N(81%) was emitted from 18-42 days of age. This data may aid in the formulation of meaningful regulations and future research will also aid in the development of new management practices to reduce the emission of ammonia.

**Key Words:** Broilers, Nitrogen, Ammonia

**438 Beak Trimming of Leghorn Pullets 3: Behaviour and welfare effects.** K. Schwan-Lardner\*, H. L. Classen, and C. B. Annett, *Department of Animal and Poultry Science, University of Saskatchewan.*

Beak trimming is controversial because of the beneficial reduction in cannibalism and the proposed detrimental pain associated with the procedure. The objective of this study was to determine if age at trimming had an effect on welfare as judged by behaviour or associated traits. White Leghorn pullets (2 strains - 480 each) were assigned to four treatments: untrimmed (C), hatchery trim (0d), or farm trimmed 10d or 35d of age. Pullets were housed in floor pens (40 per pen) to 17 wks of age. Behaviour was monitored (scan samples) at 0, 7, 14, 21 and 28d post trim (PT). At 16wk of age, tonic immobility was tested on 8 pullets per strain x treatment. Adult birds were housed in cages (6 replications of 15 birds per strain x treatment), and behaviour was monitored (focal birds) at 34 wk of age. Feather cover was scored at 58 wk of age. A 2 x 2 factorial analysis was used to analyze pullet behaviour data, and a 2 x 4 factorial analysis used for all other data. 0d birds pecked less at 1d PT, had fewer birds at the feeder 21d PT, and had more birds performing inactive standing 28d PT than C birds. Birds trimmed at 10d differed from C birds with more inactive standing (0, 7, and 21d PT), less time at the feeder (14, 21d PT), and less litter pecking (7, 14d PT). As compared to C birds, 35d trimmed birds were rested more (0d PT), spent more time inactive standing and less time feeding (0,7, 14d PT), with fewer birds at the drinkers and preening (0d PT). At 28d PT, C showed higher frequency of aggressive pecking compared to 35d. Adult birds behaved similarly. Pullets trimmed at 10d and 35d of age behaved differently for a longer period of time but did not show evidence of chronic pain. Tonic immobility comparisons (apriori contrasts) of 0d and 10d vs C showed longer latency to upright in C (P=0.09), suggesting a higher fear level. Feather cover was best on 0d and 10d and poorest on C. Trimming at 0, 10 or 35d caused no long term effect on welfare, but because of speed of beak healing and efficacy of trim, 0 and 10d may be preferable.

**Key Words:** Behaviour, Fear, Feather Cover

**439 Effects of bill-trimming on the welfare of muscovy ducks.** L. Gustafson\*<sup>1</sup>, H.-W. Cheng<sup>2</sup>, E. Pajor<sup>2</sup>, and J. Mench<sup>1</sup>, <sup>1</sup>*University of California, Davis,* <sup>2</sup>*Purdue University, West Lafayette, IN.*

Studies have shown that beak-trimmed chickens may show behavioral and physiological indicators of pain post-trim, but there is little information on the effects of bill-trimming on ducks. Muscovy ducks (N=96) were housed in mixed-sex pens containing 16 birds (8 per sex), with three replicate pens per treatment. One half of the birds were trimmed (TRIM) using secateurs at 20 days post-hatch, while the other half were untrimmed controls (CONT). The average length removed from the upper bill was .51cm, or 21.1% of the bill length from nares to tip. Two ducks/sex/treatment were randomly selected as focal birds for behavioral observations, which were conducted immediately post-trim and then at 3-day intervals. The frequency and duration of all behaviors was recorded using 15-min focal animal samples until age 68 days; all birds were weighed weekly. Two observation sessions/pen/week were conducted between 0900-1100 and 1200-1500. In the days immediately post-trim, CON ducks spent 33% of their time performing bill-related behaviors (preening, feeding, drinking, exploratory pecking), whereas TRIM ducks spent only 19% of their time performing such behaviors, a marginally significant difference (p=.063). This difference decreased by one week post-trim (CON 36.5%, TRIM 26.5%; p=0.14). There were no sex differences in behavior. By 4 days post-trim there were no significant (p=0.24) differences in weight between treatments; the average weights of CON and TRIM males were 900g and 640g, respectively, while those of CON and TRIM females were 760g and 720g. By 67 days, the lower bill of TRIM was on average only 11.9% longer than the top bill and there was also evidence of feather pecking, indicating substantial bill re-growth. Our behavioral data suggest that there is probably acute pain associated with trimming, but that it is not sufficiently severe to have marked effects on feed intake. The heads of the focal birds were collected during processing for morphological analysis of the bills. TRIM ducks had scar tissue near the beak stump; bills are currently being examined for evidence of neuromas, which are considered indicators of chronic pain.

**Key Words:** Bill-Trimming, Welfare

**440 Effects of top-dressing recycled broiler litter on nitrogen mass balance.** C. D. Coufal\*, C. Chavez, P. L. Niemeyer, and J. B. Carey, *Texas A&M University, College Station.*

An experiment was conducted to access the effects of top-dressing recycled broiler on the nitrogen mass balance of a broiler grow-out facility. Six pens were used to rear five (flocks 10-14) consecutive flocks of broilers to 6 weeks of age. The bedding material in the pens was recycled rice hull broiler litter which had been used previously for 9 consecutive broiler flocks. Three pens received no litter treatment (control), while three pens were top-dressed (treated) with a thin layer (1-2 cm) of new rice hulls before each flock of birds was placed. A total of 840 broilers were used for each flock (420 bds/trmt.). Total nitrogen content of day-old chicks and all feeds was calculated as the total mass of nitrogen entering the facility. Nitrogen not accounted for from analysis of litter, caked litter, broiler carcasses and mortality was assumed to be lost from the facility (volatilized). Seasonal effects were observed regarding percent nitrogen loss from the facility when treatment was not considered. Nitrogen loss was significantly (P<0.05) higher in flocks 13 and 14 (warmer months), 26.0 and 35.5%, respectively, compared to flocks 10, 11 and 12 (cooler months), 16.7, 8.8 and 17.7%, respectively. Percent of total nitrogen partitioned into the caked litter for all flocks was significant less for the treated (4.1%) versus control (7.7%) pens due to decreased caked litter production in the treated pens. Percent of total nitrogen lost due to volatilization (ammonia) was significantly greater for treated pens compared to the controls in flocks 10 and 12, but was lower flocks 11 and 13. However, the difference in nitrogen loss in flocks 10 and 12 was of greater magnitude than flocks 11 and 13. Carbon analysis of litter samples showed increased C:N for top-dressed pens for all flocks, with flocks 10, 12 and 13 being significantly greater. Results of this experiment show that seasonality greatly influences nitrogen loss from the broiler rearing facility and that top-dressing of litter can increase the C:N in litter, which tends to increase nitrogen loss.

**Key Words:** Broilers, Nitrogen, Mass Balance

**441 In house composting of layer manure for pest control.** G. P. Martin\*, P. H. Patterson, and C. A. B. Meyers, *The Pennsylvania State University, University Park.*

An experiment was conducted to determine the effects of mechanical pile turning/mixing with the addition of hardwood shavings to manure in deep pit layer housing. A commercial six row deep-pit poultry house were assigned treatments of : two rows each with 357.5 kg shavings base-mixed (treatment A), two rows each with 725.9 kg shavings-mixed (B), one row mixed without added shavings (T), and one row without mixing or added shavings (NT). Each treatment row was 21m long with mixing of designated rows by a belt stacking composter every 3d (approximately). Additional manure was added by the mature layers over the 51d observational period. Temperature levels in the manure were significantly greater for all treatments that were mixed with averages over the period of 50.9°C (A), 51.0 (B), 50.2 (T), 41.7 (NT). Percent moisture ranges at 51d were: 37.0(T), 37.1(B), 42.0(A), 48.3(NT). The practice of in house composting with mechanical manipulation of the pit manure may serve as a main component to an IPM program in commercial poultry housing.

**Key Words:** IPM, Manure, Mechanical Composting

**977 Beak trimming of Leghorn pullets 1: Production effects.** K. Schwan-Lardner\*, H. L. Classen, and C. B. Annett, *Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada.*

Strains of White Leghorn pullets are available for commercial production that may benefit from beak trimming with regards to a reduction

in cannibalism and or an improvement in feed efficiency. The objective of this work was to study the impact of age of mild beak trimming on pullet growth and hen performance. Pullets (120 of each of two strains) were designated to one of four trimming treatments: control or untrimmed (C), trim at commercial hatchery using a Zoo-Technique Robotics Machine (0d), or trim on farm at 10d or at 35d of age. Hens (90 per strain x treatment) were housed in battery cages at 17 wk of age, and photostimulated at 18wk (6 replications per strain x treatment group with 5 cages of 3 birds or 15 hens per replication). Data were analyzed as a 2 x 4 factorial analysis, with Duncans Multiple Range Test separating means when ANOVA was significant. Birds trimmed at 10 and 35d were lighter at 57d than control pullets (kg: C=0.649<sup>A</sup>, 0d=0.647<sup>AB</sup>, 10d=0.632<sup>C</sup>, 35d=0.635<sup>BC</sup>). By 85d of age and through to the termination of the experiment, body weights of all pullets were not different. Total hen day production was lower (P=0.0629) for C birds (%: C=82.3, 0d 83.3, 10d 83.7, 35d 84.4), but hen housed production did not differ. Feed intake was not affected by trimming treatments (g/hen/d: C=110.3, 0d=108.0, 10d=107.7, 35d=108.5) but because of the higher egg production and the numeric difference in feed intake, feed efficiency was poorer for untrimmed birds (TFEM: C=2.27<sup>A</sup>, 0d=2.20<sup>B</sup>, 10d=2.19<sup>B</sup>, 35d=2.20<sup>B</sup>; TFDE: C=1.61<sup>A</sup>, 0d=1.56<sup>B</sup>, 10d=1.54<sup>B</sup>, 35d=1.54<sup>B</sup>). Mortality was not different due to treatment (%: C=2.22, 0d=3.89, 10d=3.89, 35d=5.00). Cannibalism was only found in untrimmed birds, but levels were not significantly different from trimmed birds (C=0.56, 0d=0, 10d=0, 35d=0). Trimming the beaks of pullets at a young age (0, 10 or 35d) had minor effects on pullet growth and improved feed efficiency and egg production in White Leghorn birds.

**Key Words:** Beak Trimming, Production, Feed Efficiency

## PSA - Poultry Genetics

**442 Direct and correlated response from selection for phytate phosphorus bioavailability in a randombred chicken population.** W. Zhang, S. E. Aggrey\*, R. I. Bakalli, G. M. Pesti, and H. M. Edwards, Jr., *University of Georgia, Athens.*

This study was undertaken to evaluate the direct and correlated response to a 3 generation divergent selection for phytate phosphorus bioavailability (PBA). Individual 4-week body weight (BW), BW gain (BWG), feed consumption (FC) during a 3 d period, and feed conversion ratio (FCR) were studied as correlated responses to directed selection for PBA in Athens-Canadian randombred population. There was a significant difference between the high (H) and low (L) lines for PBA. The phenotypic difference in BW between the high and low lines at generation 3 was 26 g (P<0.01). The chickens in the low line had higher BW than the high line. There were significant (P<0.05) correlated responses in BWG, FC and FCR. The line differences in the correlated traits were due primarily to changes in the H line than the L line. The correlated responses in BW, BWG and FC were mainly due to the genetic change that had occurred in H line, and little genetic change occurred in L line across generations. The mixed model procedure with an animal model was used to separate environmental effects from genetic effects in order to establish a genetic trend for the correlated traits across the generations. Comparison between phenotypic and genetic trends indicated that, the selection experiment was influenced by environmental variation in the first two generation. It was thought that changes in PBA could be related to an internal homeostatic mechanism that limits genetic progress in the L line. There is a lower threshold of phosphorus in the diet that has to be met for chicks to feed. This provides an indication that utilization of phytate phosphorus will be limited in the L line, and as a result changes in correlated traits in this line would also be limited.

**Key Words:** Selection, Phytate Phosphorus Bioavailability, Chicken

**443 Allele frequencies of genes associated with feed efficiency traits in selected and unselected population in a commercial broiler line.** P. Sharma\*, W. Bottje, and R. Okimoto, *University of Arkansas, Fayetteville.*

Various polymorphisms were identified in coding and noncoding region of genes studied in association with the feed efficiency traits. These genes included Uncoupling protein gene (UCP), Melanocortin 4 receptor (MC4R), Melanocortin 3 receptor (MC3R), and proopiomelanocortin gene (POMC). A PCR-RFLP test was developed to type the Ala118Val

polymorphism in UCP gene. Similar PCR-RFLP tests were developed for Ser76Leu polymorphism in MC4R gene and Pro61Leu polymorphism in POMC gene. UCP Val 118 allele was found to be associated with the higher feed efficiency and MC4R Leu 76 was found to be associated with the higher body weight in the selected population studied. Two populations from the same line were tested for above polymorphisms. The birds that are typed for feed efficiency are a selected population. Individuals selected based on several defined traits pass into feed efficiency trials. The population of 400 birds chosen prior to the feed efficiency selection process was screened to study the distribution and frequency of the detected polymorphisms and alleles in the unselected population. The Val118 UCP allele was found at a frequency of 0.1 among 44 birds of the selected population and at the same frequency of 0.1 in the unselected population of 400 birds. A difference in the frequency of Leu76 MC4R allele was found with the frequency of 0.435 among the selected 44 birds and 0.359 in the unselected 100 birds tested so far but the difference was not found to be significant.

**Key Words:** Feed Efficiency, Polymorphism, Allele Frequency

**444 Quantitative trait loci affecting bone mineral density in the chicken.** M. A. Schreiweis\*, P. Y. Hester, and D. E. Moody, *Purdue University, West Lafayette, IN.*

Osteoporosis is a significant problem in egg-laying strains of hens. Bone fractures caused by the loss of structural bone have resulted in a loss of markets for the spent hens and created welfare concerns. The objective of the current study was to identify quantitative trait loci (QTL) associated with bone mineral density (BMD) in a chicken resource population. Layer (White Leghorn hens) and broiler (Cobb roosters) lines were crossed to generate an F2 population of 509 hens over seven hatches. Phenotypic data collected from hens in the resource population included BW at 6, 35, and 55 wk of age as well as the BMD of the left humerus and tibia at 35 and 55 wk of age. The BMD was determined using a Norland pDexa X-ray bone densitometer. Genotypes of 25 microsatellite markers were determined on chromosomes 1 and 3 using the ABI3700 and ABI Prism Genotyper software. A preliminary regression analysis was conducted using QTL Express. The statistical model included hatch as a fixed effect and additive and dominance effects for putative QTL were fit to a linear model using least squares. Chromosome-wide significance thresholds were empirically determined following 10,000 permutations. Chromosome 1 contained a QTL for humeral BMD at 35