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. Schwean-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-Techniqueus 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^{A}, 0d=0.647^{AB}, 10d=0.632^{C}, 35d=0.635^{BC}). 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^{A}, 0d=2.20^{B}, 10d=2.19^{B}, 35d=2.20^{B}; TFDE: C=1.61^{A}, 0d=1.56^{B}, 10d=1.54^{B}, 35d=1.54^{B}). 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 affects 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

wk of age located at 15cM (P<0.05) expressing significant dominance effects (P<0.01). Chromosome 3 potentially contained two QTL for tibial BMD at 35 wk of age located at 84 and 143cM (P<0.01) and one QTL for 35 wk BW at 147cM (P<0.05). All three QTL on chromosome 3 expressed significant additive effects (P<0.01). The QTL located on chromosomes 1 and 3 explained 2.7 and 4.0% of the residual phenotypic variation for BMD of the humerus and tibia at 35 wk of age, respectively. No QTL were identified on chromosomes 1 and 3 for other traits in the analysis. Identification of additional QTL associated with BMD may facilitate selection of birds for improved bone strength through marker assisted selection. Research supported by Midwest Poultry Consortium and NRI Competitive Grants Program / USDA No. 2002-03394.

Key Words: Bone Mineral Density, Quantitative Trait Loci, Chicken

445 Molecular characterization of chicken SOCS2 gene. G. Y. Zhou* and F. C. Leung, *Department of Zoology, The University of Hong Kong, Hong Kong, China*.

Suppressor of cytokine signaling 2 (SOCS2) has been demonstrated to involve in postnatal growth in mouse, negatively regulating a wide variety of cytokine signaling like growth hormone and interleukin-6 through the JAK-STAT pathway. In Chicken, using alternative transcriptional starting sites, two transcripts of SOCS2 named variant 1 and variant 2 were discovered by 5' RACE assay. Besides, two SOCS2 proteins encoded by the variants were identified and they are composed of 156 aa and 207 aa, respectively. In order to illustrate its genomic structure, a chicken BAC clone containing the SOCS2 gene was characterized by sequencing. It was found that chicken SOCS2 gene comprises only two exons and one intron, while in human or in mouse, SOCS2 gene consists of three exons and two introns. These differences may reveal the evolutionary relationship between mammals and birds. On the other hand, RT-PCR showed that the two SOCS2 mRNAs were distributed widely in both male and female adult chicken, but the expression levels of them varied from organ to organ. In summary, chicken SOCS2 gene may modulate somatic growth of chicken as shown in mouse and the physiological relevance among the two isoforms of SOCS2 requires further investigation.

Key Words: SOCS2, Variants, Growth Hormone

446 Molecular cloning and characterization of a broiler small intestine Type IIb sodium phosphate cotransporter gene. F. Yan[1,4], C. Ashwell*[2,3], and R. Angel[1], [1]*Department of Animal and Avian Sciences, University of Maryland, College Park,* [2]*Growth Biology Lab., Animal and Natural Resources Institute, USDA-ARS, Beltsville, MD,* [3]*Department of Poultry Science, North Carolina State University, Raleigh,* [4]*Department of Poulty Science, University of Arkansas, Fayetteville*.

Intestinal absorption and renal resorption play a critical role in overall homeostasis of phosphorus in chickens. Using RNase-Ligase-Mediated Rapid Amplification of cDNA Ends (RLM-RACE) PCR, we have obtained a cDNA from the broiler small intestine, that encodes a type IIb sodium-dependent phosphate transporter. The cDNA has an open reading frame of 2022 base pairs and predicts a protein of 674 amino acids with the calculated molecular mass of approximately 74 kDa. Amino acid hydropathy predicts eight transmembrane domains, with intracellular NH2 and COOH termini. The Na/Pi IIb cotransporter has high homology with other type II Na/Pi cotransporters, but low homology with the type I or type III Na/Pi cotransporters. The Na/Pi IIb transporter is located on chicken chromosome 4 at 73.61 Mb where a gene was predicted by the Ensemble database. A microsatellite marker is present within intron 5 of the genomic structure. Northern blot analysis demonstrated the presence of a single mRNA transcript present predominantly in the small intestine with the highest expression in the duodenum, followed by the jejunum and ileum. In situ hybridization indicated that the Na/Pi cotransporter mRNA is expressed throughout the vertical crypt-villus axis of the small intestine. Further study is needed to elucidate its physiological role in the intestinal absorption of phosphatein chickens.

Key Words: Small Intestine, Phosphorus, Absorption

PSA-Nutrition: Alternate Ingredients and Gastrointestinal System

447 Relative toxicity of gossypol isomers in laying hens. M. M. Lordelo*[1], A. J. Davis[1], M. C. Calhoun[2], and N. M. Dale[1], [1]*Poultry Science Department, University of Georgia, Athens,* [2]*Texas A&M University Research Center, San Angelo*.

Cottonseed meal has been proposed as a protein source for poultry diets, but concern over the presence of the potentially toxic factor, gossypol, has limited its use. Gossypol is a polyphenolic compound that exists as either a positive (+) or negative (-) isomer. An experiment was conducted to determine the relative toxicity of each gossypol isomer in laying hens. Twenty-five individually caged Hy-Line W36 43 wk-old layers were fed a corn/soy diet supplemented with either 0, 200 (+), 400 (+), 200(-) or 400 (-) mg/kg of pure gossypol isomer for 20 d (5 pens /treatment). Feed intake, egg production and egg weight were monitored daily. Birds were weighed on d 1 and d 20. All eggs were individually opened and scored for yolk discoloration using a scale of 0 (no discoloration) through 10 (complete discoloration). Subsequently, yolks were separated for gossypol analysis. At the end of the experiment, tissue samples were collected for determination of gossypol isomer levels. Total egg production was equivalent for birds fed either the control or the (-) isomer diets. Birds fed the (+) isomer, however, had lower (P<0.05) total egg production. After d 10, egg weight was significantly decreased from birds fed either level of the (+) isomer when compared to the control-fed birds. Eggs produced by the layers fed the (+) isomer had severe yolk discoloration. Although average egg yolk discoloration scores were equivalent between birds fed either the control diet or the diets supplemented with the (-) isomer, there were a few eggs with a score of 3 detected for the (-) isomer treatment but not for control treatment. Total feed intake was lower for birds consuming the 400 mg/kg level of (+) isomer when compared to the birds on the other treatments. Final body weights were not different between the controls and the other treatments. Tissue and yolk accumulation of the (+) gossypol isomer was higher than the (-) isomer. Additionally, there was no racemization of the isomers in the tissues and yolks of the laying hens. The results indicate that the (+) gossypol isomer is responsible for the negative impacts associated with feeding cottonseed meal to laying hens.

Key Words: Gossypol Isomers, Cottonseed Meal, Laying Hens

448 Effect of increased heat processing on phosphorus (P) bioavailability in corn distiller dried grains with solubles (DDGS). C. Martinez Amezcua*, L. E. Markovic, and C. M. Parsons, *Department of Animal Sciences, University of Illinois, Urbana*.

A few previous studies have shown that heat processing may increase the bioavailability of phytate-P in some foodsfutts. Therefore, two chick experiments were conducted to determine the effect of various increased heat processing treatments on bioavailability of P in DDGS. In addition, two precision-fed cecectomized rooster assays were conducted to evaluate the effects of the heat treatments on amino acid digestibility, particularly lysine. For the chick assays, a P-deficient cornstarch-dextrose-soybean meal basal diet containing 0.10% nonphytate phosphorus was formulated. A standard curve was then constructed by adding 0.0, 0.05 and 0.10% P from KH_2PO_4 to the basal diet. For the DDGS treatments, a commercial sample of DDGS was obtained and then subjected to increased heat processing by autoclaving at 124 kPa and 121C or by heating in a drying oven at 121C. The various DDGS samples were then added to the P-deficient basal diet at levels of 7 to 14%. New Hampshire x Columbian male chicks were fed the experimental diets from Day 8 to 22 post-hatch, and growth performance and tibia ash were measured. Bioavailability of P was estimated using the slope-ratio method, where tibia ash was regressed on P intake from KH_2PO_4 or DDGS. In the first experiment, bioavailability of P in DDGS (% of total) was increased (P<0.05) from 75 to 87% by autoclaving for 75 min. In the second chick assay, P bioavailability was significantly increased (P<0.05) by autoclaving for 60 and 80 min, but not for 40 min. The effects of oven drying on P bioavailability were inconsistent. Lysine digestibility of DDGS determined by the cecectomized rooster assay was substantially decreased