diets, collect biological samples, and record data. During the fifth week, a group discussion of the results is conducted. Students are responsible for retrieving the lab information and the compiled data from the web prior to participating in the discussion. The swine lab consists of evaluating the effect of fat supplementation on lactational performance and milk composition in lactating sows. The objective of the poultry lab is to evaluate the effect of feeding diets deficient methionine concentration on egg production in laying hens. The poultry lab prac is conducted over a 10-day period. The equine lab consists of testing the effect of feeding a legume hay versus a grass hay on the nitrogen balance of the horse. Students work in groups of four, and rotate every 6 hours over a 5-day collection period. Students are required to submit a complete report for each lab category. The lab report is written following a guideline provided on the web. Reports must integrate the knowledge gained from diet formulation and lab prac results, and theory learned in class.

Key Words: Nutrition, Laboratory, Teaching

519 Utilization of small-group special species projects to facilitate undergraduate applied animal nutrition learning experiences. J.R. Carpenter*, *University of Hawai'i at Manoa, Honolulu, HI USA*.

Over the past five years, the use of a small group "Special Species Project" has been adopted as a major learning component for our undergraduate applied animal nutrition course. This philosophy was adopted to assist students in: 1) addressing the desired CTAHR graduation competencies, 2) fulfilling their writing intensive course requirements, 3) developing their interpersonal and communication skills by working in small groups of 2 or 3, 4) developing research and problem-solving abilities, 5) applying principles of ration balancing, 6) enhancing computer skills and use of computers in diet formulation, and 7) improving public speaking skills. Because of the intensity of the course and the small class size (only 20 students), it has been very successful during the brief time it has been implemented. The class has encompassed the following species: equine, bovine, ovine, caprine, avian, porcine, canine, feline (both companion and exotic), marine mammals (dolphin and monk seal), and various aquatic species (both carnivorous and herbivorous fish and crustaceans). Since the students are involved in species assignment, there is genuine interest, increased energy, enthusiasm, and the desire to learn. So many undergraduates are raised in urban settings, lacking the practical experiences and exposure to animal production and companion/zoo-related industries, their feeding programs and specialized equipment/facilities. Students contact industry and community representatives and become aware of the diversity of animal nutrition as a career. In the course, students are also exposed to critical review of scientific journal articles and the use of the internet, popular press, and other sources of information as resources. They frequently express appreciation for the practical application of principles and special skills learned in previous lectures/labs. Although much of the effort is guided, there still is flexibility for the students to complete requirements within the semester time constraints. Challenges of the course will also be discussed.

Key Words: Small group active-learning, Applied animal nutrition , Instruction

PSA Environment and Management: Composite Group

520 Interaction of feeding program and space on broiler breeder egg production. J. Brake*, *North Carolina State University, Raleigh, NC USA*.

Broiler breeder pullets (Cobb 500 FS) were placed in 12 pens, each of which contained 12 Kuhl DH-4 38 cm (15-inch) diameter feeders. There were 19 pullets per pan in all pens to 14 weeks of age. Density was 6.9 birds per square meter. Pullets were randomly removed from all pens at 14 weeks of age to achieve either 15 or 18 pullets per pan to 22 weeks of age. This gave densities of 5.4 or 6.4 birds per square meter. During the rearing period pullets were fed on either a Low, Medium, or High program that provided 24,240 kcal ME and 1296 g CP, 26,020 kcal ME and 1391 g CP, or 27,780 kcal ME and 1485 g CP, respectively, at 21 weeks of age. With the exception of space, feeding and management were identical among the treatments following movement to breeding quarters and photostimulation at 22 weeks of age. Early egg production responded positively in a dose-related manner to feeding program but no overall difference was observed due to space. Inspection of the interaction revealed little effect of space on the High or Low programs but an obvious improvement in egg production due to more space on the Medium program. These data suggest that space has little effect when all pullets are nutrient deficient (Low) or nutrient replete (High) but has a measurable effect on egg production when cumulative nutrition is marginal.

Key Words: Feeder Space, Floor Space, Density

521 Early protein intake influences long term egg production by broiler breeder hens. R.J. Lien*, J.B. Hess, and W.D. Berry, *Auburn University, Auburn, AL*.

A total of 800 Cobb 500 strain broiler breeder hens provided either high or low protein intake to 4 wk of age were subsequently provided equal allotments of the same feeds through 65 wk to determine long term effects on egg production. Feeds containing 2860 Kcal ME/kg and either 19(high) or 15%(low) CP were provided *ad libitum* to 2 wk, in limited daily allotments to 3 wk, and in limited allotments on 4 of 7 d/wk during wk 4. Allotments were adjusted so total feed intake to 4 wk was 0.95 kg/bird in both trts. This resulted in total CP intakes to 4 wk of 142g (low) and 180g (high). Equal allotments of a 15% CP developer feed were provided both groups on 4 of 7 d/wk from 4 to 21 wk and daily from 21 to 23 wk. A photoschedule of 8h L:16h D was provided to 21 wk and 15h L:9h D was provided from 21 to 65 wk. Peak feed allotments of 159 g/hen/d were provided from 29 to 32 wk. Allotments were then decreased 4.0 g/hen/wk for 2 wk, and 0.9 g/hen/wk thereafter. At 4 wk, BW of high and low CP trts were 577 and 540 g, respectively. However, BW of the 2 trts did not differ from 9 to 65 wk. At 65 wk, mean BW was 3.87 kg. Feed consumption rate was greater in the high trt at 4, 6 and 8, but not 10 wk. Bone in breast wt, shank and keel length, and carcass moisture, CP and ash were all greater in the high trt at 4 wk. Fat pad wt and carcass fat were greater in the low trt at 4 wk. There were no differences in carcass composition at 21 or 30 wk. Uniformity was greater in the high trt at 4 wk; however, no differences were seen at 21, 25 or 30 wk. Age at onset of lay did not differ between trt. Total egg production/hen at 65 wk were 157 and 141 in the high and low treatments, respectively. Egg production did not differ between trt from 25 to 35 wk. However, from 36 to 45, 46 to 55, and 56 to 65 wk, egg production/hen in the low trt was reduced by approximately 4, 5 and 5 eggs, respectively. Egg wt and specific gravities did not differ between trt. Increased early CP intake had no measureable long term effects on BW or carcass composition, but resulted in greater post-peak and total egg production by breeder hens.

Key Words: Broiler Breeder, Protein Intake, Egg Production

522 Body weight management and performance of broiler breeder males. Wallace Berry*[1], Pingbo Liu[1], Haitao Li[1], and Alex Peterson[1], [1]*Auburn University Department of Poultry Science*.

Complex feeding programs for broiler breeders require intensive management. Underestimation of feed allotments can permanently damaging fertility. To avoid this, males are often allowed to become too large. One possible strategy to reduce these risks is to restrict growth early to keep the birds below the usual body weight targets while still allowing growth. This would provide an increased margin of error between actual growth and the desired growth targets. To test this strategy, male chicks in the Small group were full fed standard 22% broiler starter until they reached 1.2 lbs average body weight. Chicks in the Large group were full fed starter until they reached 1.9 lbs body weight. When the chicks in each group reached target body weight, they were switched to a 12% protein rearing diet and fed to maintain positive growth rates and body weight divergence through week 21. At 21 weeks of age, the male birds were placed with females in pens in a curtain sided, slat/litter breeder house. The ratio of females to males was 10:1. Lighting schedule was arranged to provide 14 hours of light with an increase of 15 minutes of light each week to a maximum of 16 hours light. Body weights were measured every 4 weeks. Weekly fertility was monitored by breakout of eggs following 7 days of incubation. Every fourth week eggs were incubated to

hatch to determine hatchability and embryonic mortality. Small males were 1.25 lbs at week 3, 5.5 lbs at photostimulation, 8.5 lbs at peak, and 9.75 lbs at week 45. Large males were 1.9 lbs at 3 weeks, 7 lbs at photostimulation, 9.75 lbs at peak, and 11.2 lbs at week 45. Weight uniformity at 21 weeks of age was 84% for the small males and 85% for the large males. Small males suffered less culling and mortality than large males (22% vs. 30%). Small males gave an overall mean fertility rate of 97.75 % as compared to 96.6% for the Large males with the greatest differences occurring before and after peak production. Differences in embryonic mortality were slight. The results of this study indicate that heavy breeder males can be maintained at body weights below guideline recommendations, but with continued growth, up to peak production without adversely affecting fertility and hatchability.

Key Words: Breeder, Body weight, Fertility

523 The effects of feeding different levels of protein with and without the DFM, Primalac, on production parameters of bobwhite quail. G. S. Davis*[1] and L R. Minear[2], [1]*NC State University, Raleigh, NC USA,* [2]*Southern States Cooperative, Providence Forge, VA USA.*

The Bobwhite quail (BQ) is an upland wild gamebird in the USA, and its numbers have declined approximately 80% in the wild during the past 40 years. Consequently, 20,000,000 BQ are produced each year with the majority of these birds being raised and released on commercial hunting preserves. Producers of BQ typically experience high mortality during the rearing period. However, previous research has shown that adding PrimaLac (P), a Direct-Fed Microbial (DFM), to the diet significantly reduced BQ mortality and improved body weight (BW) gain and feed efficiency (FE). There is very little information regarding the dietary protein requirements of BQ. Therefore, a study was conducted to examine production parameters of BQ provided different levels of dietary protein (DP) with and without P from 1 d to 10 wk of age. 720 BQ were divided into 8 Trt groups and randomly placed into 6 replications each. A 2 X 2 factorial arrangement of Trts with 4 DP levels and 2 P levels (0 and 2 lbs/ton feed) consisted of the following dietary regimens: Trt 1=28% DP starter for 5 wk and 24% developer for 5 wk; Trt 2=26% DP starter for 5 wk and 20% DP developer for 5 wk; Trt 3=28% DP starter for 10 wk; Trt 4=30% DP starter for 2 wk and 26% DP developer for 8 wk; Trt 5=Trt 1+P; Trt 6=Trt 2+P; Trt 7=Trt 3+P; Trt 8=Trt 4+P). Livability was enhanced by the DFM during the first 2 wk. BQ fed 28% and 30% DP with P exhibited consistently heavier BW from 6 to 10 wk. Cumulative FE at 10 wk was improved in the DFM Trts (5.28) compared to BQ with 0 DFM (5.30). BQ feather score at 10 wk in the DFM Trts (6.75) was greater than that of the 0 DFM Trts (4.6). It was concluded that dietary P can enhance livability, BW, and feather score in BQ.

Key Words: Bobwhite quail, DFM

524 Effect of Acut Heat Stress on Some Productive and Physiological Traits of Bronze Turkey. Talat, M. El-Sheikh*[1] and Mordy, A. Kalamah[2], [1]*South Valley University, Faculty of Agriculture, Sohag, Egypt,* [2]*Menofia University, Faculty of Agriculture, Menofia, Egypt.*

The objective of this study was to investigate the effect of acut heat stress on physiological and productive traits of the Bronze turkey. One hundred and two Bronze turkey at 10 weeks of age were divided into three treatments and placed in climate chambers at 45C and 40% RH (heat stress) for two hours, the first and second groups were exposed for two and three times weekly and the third group reserved as control. Birds were given feed and water ad libtum and weighed biweekly from 10 to 32 weeks of age. Body temperature, respiration rate were measured weekly per bird before and after heat stress. Semen quality and blood constituents were measured at 12, 20 and 28 weeks of age after exposure of heat stress. The results revealed that the high temperature caused significantly reduction in body weight and growth rate. Respiration rate and body temperature were significantly ($P<0.01$) higher in birds exposed to heat stress than those in control. The toms exposed to heat stress had significantly lower sperm motility, concentration ($P<0.01$), and live and abnormal sperm ($P<0.05$) than control toms. However, ejaculate volume and semen pH were not significant. Heat stress caused significantly reduction in plasma total protein, albumin globulin, total lipids, calcium and inorganic phosphorus, creatinine, T4, growth hormone ($P<0.01$), and T3 ($P<0.05$) of birds. However plasma cholesterol and alkaline phosphatase did not differ between birds exposed to heat stress and control.

Key Words: Bronze turkey, Heat stress, Productive traits, Physiological parameters

525 Effect of dietary diacetoxyscirpenol and fusaric acid on turkey poult performance. A.S. Fairchild*[1], J.L. Grimes[1], J.K. Porter[2], W.J. Croom[1], L.R. Daniel[1], and W.M. Hagler, Jr.[1], [1]*North Carolina State University, Raleigh, NC USA,* [2]*R.B. Russell Agricultural Research Center, USDA/ARS, Athens, GA USA.*

Effects of dietary diacetoxyscirpenol and fusaric acid were determined on day-old turkey poults by randomly placing poults in batteries and feeding them one of four dietary treatments: control (C); control plus 4ppm diacetoxyscirpenol (DAS); control plus 300ppm fusaric acid (FA); and control plus 4ppm DAS and 300ppm FA (DF). There were 10 poults per pen with 6 replicate pens per treatment. Individual BW, BW gains (BWG) and pen feed consumption were determined at d6, 12, and 18. Period and cumulative feed to gain was calculated. Relative liver, spleen, bursa, intestine, and jejunum weights were measured at d18. Mouth lesions were scored for treatments at d18. Performance parameters were regressed on treatment means using the GLM Procedure of SAS®. Means were separated using LSMEANS with significance level set at $P\leq0.05$. FA had no effect on BW or BWG at any period compared to C. Poults fed DF had reduced BW and BWG compared to C, while poults fed DAS had lower BW than all treatments at every period. Final BW were: C (451.7g), FA (464.9g), DF (389.0g), and DAS (351.4g). Poults fed FA or C had better feed to gain than poults fed DAS or DF (1.05 and 1.04 vs. 1.19 and 1.15, respectively) at d6. However, the effect of FA was transient: there were no differences among the treatments at d12 or d18. Poults fed FA had significantly lower relative intestine wt than poults fed other diets, and had significantly higher relative bursa wt at d18 when compared to poults fed DAS or DF. Poults fed DAS or DF had higher mouth lesion scores than poults fed FA or C, but mouth lesion scores in DAS and DF poults were not different from each other (4.48 vs. 4.64). In conclusion, dietary DAS resulted in decreased poult performance, while dietary FA had little or no effect. However, FA fed in combination with DAS resulted in some protective effect towards DAS.

Key Words: Diacetoxyscirpenol, Fusaric acid, Turkey

526 The effect of a biological litter treatment on microbiological litter quality in turkey breeder flocks. T. Wiard*[1], M. Gockley[1], G. Troyer[2], and T. Rehberger[1], [1]*Agtech Products, Inc., Waukesha, WI,* [2]*Willmar Poultry Co., Willmar,MN .*

A study was conducted to determine the effects of a biological litter treatment on the quality of litter in turkey breeder flocks. A flock of breeder hens were moved from a brooder barn at five weeks of age and divided into two grower barns. One barn was used as a control barn with no biological litter treatment applied, while the second barn was treated with a biological litter treatment. At twenty-eight weeks of age hens from the control grower barn were moved into two layer control barns, and hens from the treated grower were moved into two treated layer barns. In both facilities, the litter treatment was reapplied to the treated barns every ten weeks. Biweekly litter samples were taken and serial dilutions were used to enumerate total gram-negatives, coliforms, and *E. coli* found in the litter. Additionally, monthly drag swabs were collected and used to determine the presence of *Salmonella* in each barn. In the grower phase, total gram-negative bacteria in the litter were reduced by 65%, coliforms by 69.5%, and *E. coli* by 6.3% in the treated barn compared to the control barn. In the grower barn, the initial *Salmonella* drag swab samples for both the treated and control barns were negative. In the control barns, the number of positive *Salmonella* samples rose to 60% by the second sampling, and to 80% by the third sampling, where they remained until the birds were moved out of the grower barns. During the same time period, *Salmonella* remained at an undetectable level in the treated barn. In the initial drag swab samples from the layer barns, only one sample was positive for *Salmonella* in the treated barns compared with three positive samples from the control barns. By the eleventh week in the layer barns, 40% of the samples tested positive for *Salmonella* in the control barns, while *Salmonella* was at an undetectable level in the treated barns. The biological litter treatment was effective in controlling the number of total

gram-negatives, coliforms, *E. coli*, and *Salmonella* present in litter from turkey breeder flocks.

Key Words: Turkey, Litter, *Salmonella*

527 Sex differences in some hatching parameters. Akrum Hamdy*, *Animal Prod.,Dept.,Fac.,of Agric.,Minia Univ., Egypt.*

One thousand and hundred fertile eggs of Hisex Brown layers were used in this study. Variations in hatching time as affected by egg size and their subsequent effect on hatch weight, placement weight and sex ratio were evaluated. Egg weight had a positive correlation coefficient with hatch weight and placement weight (0.664 and 0.656, respectively). While it has a negative value with hatching time (-0.602). Female chicks tend to hatch earlier than males. About 71% of females had hatched by 506 hrs. whereas 55% of the males had hatched at a comparable time. Greater weight loss in females than males may be due to evaporation, which occured in the hatcher. From these results, it may be advantageous to develop procedures for harvesting female chicks more than one time during the hatching period.

Key Words: Sex Differences, Hatching Time, Egg Size

528 Real time incubation temperature control and heat production of broiler eggs. R. M. Hulet*[1] and R. Meijerhof[2], [1]*Pennsylvania State University, University Park, PA,* [2]*Hybro BV, Boxmeer, NL.*

Previous research has shown the value of controlling heat production during incubation for high-meat yielding broiler eggs. The purpose of this study was to evaluate the effect of maximizing heat production from five to eighteen days of incubation on hatchability and embryonic mortality. Two trials were conducted using 115,200 eggs from broiler breeders between 42 and 45 weeks of age (Lagerwey BV, NL) in two Hatchtech^{TM} incubators. After five days of age, temperature of the setter was adjusted to maximize heat production of the egg mass. Temperature, humidity, and carbon dioxide measurements were recorded every fifteen minutes during the incubation period. Weight loss, fertility, stage of embryonic death, chick weight, and hatchability were recorded for each incubator. Test incubators were compared to control incubators that contained eggs from the same flocks. Results showed a two percent increase in hatchability (90.3 and 89.3 versus 88.2 and 86.8 percent) for the test incubators when compared to the control setters that resulted, primarily, from decreased late dead embryos. Heat production was found to be .20 and .19 watt/egg, respectively for trial I and II which was similar to previously reported for high yielding broilers. In summary, real time monitoring of incubation can result in gains in hatchability by controlling embryonic heat production during critical periods of incubation.

Key Words: Incubation, Embryonic Heat Production, Temperature

529 Reduction of turkey hatching egg shell contamination with ultraviolet irradiation. R. A. Russo*, C. Chavez, T. P. Niemeyer, P. L. Reynolds, and J. B. Carey, *Texas A&M University, College Station, TX.*

The germicidal effects of 254nm ultraviolet light (UV) have been well documented in other sanitation applications. Field trials were conducted to test the impact of UV exposure on turkey hatching egg shell microbial contamination. An egg washing unit (with a motorized finger-type conveyor belt) was modified to be utilized as a UV chamber. Nine 40 watt lamps (three on top and three on each side) were placed in the UV chamber. The lamps operated at an intensity of $\geq$10.84mW/cm ^{2} and egg exposure time was 45 seconds. The conveyor belt allows for the eggs to pass through individually and rotate on the longitudinal axis as they pass through the chamber, allowing full exposure of the shell to the UV radiation. Five trials were conducted with eggs from commercial turkey breeder flocks. Sixteen eggs were used in each trial (8 controls, 8 treated). After treatment, eggs were placed in 50mL of sterile phosphate buffer solution (PBS) and massaged for 4 s. Serial dilutions of the PBS were plated in duplicate on plate count agar (PCA), eosin methylene blue agar (EMB) and brilliant green agar (BGA). All plates were incubated at 37C for 48h before enumeration. In all trials, PCA counts of treated eggs were significantly lower than those of controls. *Salmonella* colonies detected on EMB was significantly lower on treated eggs in 4 of the 5 trials, and not significantly different in the other 1. *E. coli* colonies enumerated on EMB were significantly lower in 2 of the trials, and not significantly different in the other 3. *Salmonella* colonies enumerated on BGA were significantly lower on treated eggs in 2 trials, and not significantly different in the other 3. *E. coli* colonies detected on BGA were significantly lower in 2 of the trials, and not significantly different in the other 3. These data indicate a potential for reduction of egg shell microbial contamination of turkey hatching eggs with UV irradiation.

Key Words: UV irradiation, Turkey hatching eggs, Egg shell contamination

530 The effects of age at photostimulation on reproductive efficiency in three strains of broiler breeders varying in breast yield. N. S. Joseph*[1], F. E. Robinson[1], R. A. Renema[1], and M. J. Zuidhof[2], [1]*University of Alberta, Edmonton, AB, Canada,* [2]*Alberta Agriculture, Food and Rural Development, Edmonton, AB, Canada.*

The effects of photostimulating at 20 versus 23 wk of age were examined in three strains of female broiler breeders (Arbor Acres Farms Inc.; Classic, Feather Sexable Yield [FSY], and an experimental line [EXP]). The EXP line had been selected for more breast muscle yield than the other two strains. One objective was to determine if genetic selection for meat yield has changed the age at onset of lay. A second objective was to examine varying ages at photostimulation. At 19 wk of age, 48 pullets from each strain were housed in individual laying cages. The photoperiod during rearing and at the time of placement was 8 h of light/d. A solid black curtain was placed down the center of the room, dividing it into two halves. At 20 wk of age, one-half of the birds were photostimulated by increasing the photoperiod to 15 h of light/d. The other half remained on 8 h of light/d until 23 wk of age when they received the same increase in photoperiod as the 20-wk treatment.
Strain of bird had no effect on age at sexual maturity. Birds that were photostimulated at 23 wk of age weighed more and were older at sexual maturity than birds photostimulated at 20 wk of age (185.6 and 180.0 $\pm$ 1.1 d of age, respectively). However, once photostimulated, the pullets in the 23-wk treatment took less time to reach peak production than those in the 20-wk treatment. The later-photostimulated group had a higher mean egg weight throughout lay. There was no strain or treatment difference in hen-day egg production or settable egg number. Breast weight was heavier for EXP than Classic and FSY hens at 53 wk of age. The later-photostimulated group had more large yellow follicles than the early-photostimulated group. Although there were strain differences in breast muscle weight, strain did not affect the number of eggs produced. Delaying photostimulation by 3 wk was effective as hens began production faster and had an increased egg weight throughout lay without a decrease in egg production.

Key Words: Broiler breeder, Photostimulation age, Reproductive parameters

531 The effect of administering Oasis^{TM} hatching supplement prior to chick placement on growth and body weight uniformity of female broiler breeders. S. I. Boersma*, F. E. Robinson, G. M. Fasenko, and R. A. Renema, *University of Alberta, Edmonton, AB, Canada.*

Transportation of broiler breeder chicks may cause energy loss and dehydration during the time period between hatch and placement. Arbor Acre Classic broiler breeder pullets were used to examine the effects of chick hatch condition on flock BW uniformity. Chick hatch condition assessment included eggshell quality, moisture loss, chick weight at hatch and chick weight 36 h post-hatch. A total of 2500 broiler breeder parent eggs were incubated and 856 female broiler breeders were successfully pedigree hatched in order to match egg and chick weights. An equal number of chicks received one of two treatments as follows; Assisted (AST), received Oasis (Novus International Inc., St. Louis, MO) for 36 h; Control (CON), received no hatching supplement. Chicks were placed in 8 floor pens (107 birds/pen) in a light-tight facility from 36 h post-hatch to 18 wk of age. Individual BW were recorded at 1, 2, 3, 4, 8, 12, 16, and 18 wk of age. Feed allocation was determined according to group BW following breeder guidelines.
Eggshell quality, egg set weight and chick hatch weight were similar between AST and CON treatment groups. The AST post-hatch weights were lower than CON (37.24 g compared to 37.86 g, P = 0.0058). However, BW for AST treatment were higher than CON for 1, 2, 3 and 4

wk, as well as the BW gains for 0-1, 2-3 and 16- 18 wk. The AST treatment showed more variation in BW uniformity at wk 1 (CV of 10.21%) than CON treatment (CV of 9.16%). Overall, AST and CON birds had similar BW uniformity throughout the rearing period. Whereas Oasis treatment did not affect pullet BW uniformity beyond 1 wk of age, it may contribute to enhanced BW and BW gains during the first 4 wk of the rearing period.

Key Words: Broiler breeders , Body weight uniformity, Chick quality

532 Physical traits and reproductive success in male primary broiler breeders. S. McGary*[1], I. Estevez[1], M. R. Bakst[2], and D. L. Pollock[3], [1]*Univ of MD, College Park, MD 20742,* [2]*USDA-ARS, Beltsville, MD 20705,* [3]*Perdue Inc, Salisbury, MD 21802.*

Genetic selection for high yield in primary broiler breeder males may result in skeletal modifications that impede sperm transfer upon mating. In addition, fluctuating asymmetry (FA) in bilateral traits has been shown to reliably indicate male reproductive potential in some avian species. The goal of this study was to determine if physical variation due to genetic selection and FA could explain and predict differential fertility and semen quality in male broiler breeders. Sixty males from two primary broiler breeder strains (A and B) were individually housed with an average of 10 females. Fertility was estimated by examining the germinal disc (GD), and semen quality by counting sperm penetration (SP) through the perivitelline layer. At 50 wks, body weight (BW) was taken and males euthanized. Posterior pelvic length and width (PPL and PPW), dorsal pelvic length and width (DPL and DPW), tarsometatarsal length and width (TL and TW), and wattle length and width (WL and WW) were measured with digital calipers. Strain differences included BW ($P<0.01$), WL ($P<0.0001$), WW ($P<0.0001$), PPL ($P<0.01$) and DPW ($P<0.001$). The degree of FA in TL ($P<0.05$) and WL ($P<0.05$) was greater in Strain A, however FA did not correlate with fertility or SP in either strain. Strain A WL correlated with SP ($r=0.295$; $P<0.05$). There was a negative relationship between Strain A fertility and DPW ($r=-0.298$; $P<0.05$). Strain A DPW alteration may affect sperm transfer upon copulation, however, this correlation was weak and should be further investigated to validate the relationship between pelvic structure and copulatory success. Fertility and SP did not correlate with physical traits in Strain B. Strain differences demonstrate potential impact of selection on physical traits. A significant relationship between comb size and Strain A fertility has been previously shown, and the present study provides further evidence supporting evaluation of sexual traits as fertility indicators for Strain A.

Key Words: Broiler breeder, Fertility, Genetic selection

533 Effects of rearing feed intake on carcass characteristics of male broiler Breeders to 26 wk of age. R. H. McGovern*[1], J. L. Wilson[1], F. E. Robinson[2], and L. F. Bouvier[2], [1]*The University of Georgia,* [2]*University of Alberta.*

Male broiler breeders require adequate fleshing to attain sexual maturity, while at the same time must remain lean enough to prevent them from becoming too large to mate naturally during the breeding period. Knowledge of the skeletal and carcass characteristics of male broiler breeders has been proposed as a management technique. Four hundred and eighty commercial male broiler breeders were reared in 12 floor pens. Birds were assigned to one of four rearing feed level treatments: standard (SF) (recommended BW profile), plus 15% (P15) (BW approximately 15% heavier that the SF), plus 30% (P30), and full fed (FF) at 1 d of age. Starting at 21 wk of age, male BW was restricted to attain the recommended breeder BW at 24 wk of age. Shank length, keel length, chest width, head width, and comb height were recorded for all birds. Forty birds (10 birds per treatment) were dissected at 6, 12, 18, 20, 22, 23, 24, 25, and 26 wk of age. Shank color and a visual shank color score of all males were assessed from 12 wk of age. The FF treatment males had the greatest gain from 5 to 6 wk of age (334 g) and maintained the greatest BW at 18 and 20 wk of age (3395g and 3747g, respectively). At 6 wk, the FF and P30 treatment males had the greatest fatpad weight compared to the SF bird (17.3g and 18.2g, respectively compared to 7.5g). The FF males had a greater BW and greater breast muscle development than the other BW treatments at 12, 18, and 20 wk. There were no differences in testes weight among the treatments prior to photostimulation at 22 wk. Head width, comb height, chest width, keel length, and shank length were increased in early rearing with feeding level. From 22 to 24 weeks of age, the FF males are in a period of BW weight loss. Testes of birds in the FF treatment were smaller compared to the P30, P15, and SF treatment males at 24 wk (11.7 g, 26.6 g, 29.2 g, and 25.5 g respectively).

Key Words: Male broiler breeders, Carcass characteristics , Testes

PSA Immunology

534 Major histocompatibility (B) complex gene dose effects on Rous sarcoma virus tumor growth. T. A. Tupick[1] and R. L. Taylor, Jr.*[1], [1]*Dept. of Animal and Nutritional Sciences, University of New Hampshire, Durham, NH 03824.*

This study's objective was to examine major histocompatibility (B) complex (MHC) gene dosage effects on the outcome of Rous sarcomas. Matings between Line UNH 193 ($B^{19}B^{19}B^{19}$) trisomic sires and dams produced progeny having $B^{19}B^{19}$ (disomic), $B^{19}B^{19}B^{19}$ (trisomic) or $B^{19}B^{19}B^{19}B^{19}$ (tetrasomic) MHC chromosome doses. The MHC and the nucleolus organizer region (NOR) are both located on a medium size mirochromosome, designated 16. Nucleoli from feather pulp cells were enumerated using phase-contrast microscopy to determine chromosome dose. Six-week-old chickens were inoculated in the wing-web with 30 pock forming units (pfu) of subgroup A Rous sarcoma virus (RSV). Tumors were scored for size six times over a 10-wk period. The six tumor size scores were used to assign a tumor profile index (TPI), which indicates the degree of tumor growth. The TPI values, based on the general regressive nature of the B^{19} haplotype in these chickens, were 1 = complete regression by 28 days, or earlier; 2 = complete regression by 42 or 56 days; 3 = complete regression by 70 days, or a decreasing slope, or complete regression by 56 days followed by recurrence; 4 = general upward trend, or plateau or slight regression after 56 days; 5 = terminal tumor prior to 70 days. Mean tumor size scores were evaluated by repeated measures analysis of variance. The TPI values were rank transformed and analyzed by ANOVA. Fisher's Protected LSD at $P<0.05$ separated significant means. The 88 chickens that developed tumors were 28 disomic, 47 trisomic and 13 tetrasomic types. No difference in tumor growth over time was detected among the three MHC gene doses with most chickens regressing their tumors. Disomic chickens had a significantly lower TPI than trisomic but not tetrasomic chickens. The TPI of trisomic and tetrasomic chickens did not differ significantly. These data indicated that MHC dose alterations, at least to the trisomic level, have a negative impact on Rous sarcomas tumor outcome.

Key Words: Oncogene, Tumor, Aneuploid

535 Wattle swelling and antibody titers in BSA hypersensitive and naive hens. Paul Cotter*[1] and Swami Halidi[2], [1]*Framingham State College,* [2]*Department of Animal and Poultry Sciences, University of Guelph, Canada.*

Wattle swelling was measured at 4, 24, 48, and 72 h in hens challenged with BSA. The swelling responses in those hens previously sensitized to BSA were greater at measurements up to 48 h compared to naive hens. Extraordinary swelling was observed in 10, 6 and 3 of 13 sensitized hens and in none of the naive hens at 4, 24 and 48 h respectively. Thus 19 of 39 (49%) of the presensitized group responses were not considered salutary versus none in the naive group. There was a slight tendency for the sensitized hens to show weight loss at one wk after the challenge but some loss occurred in certain naive hens as well. The log2 antibody titers to BSA were detected by passive hemagglutination. These were 2.8 in naive hens and 8.0 in the sensitized hens at the time of the wattle challenge. Titers rose to 8.0 in naive hens but fell slightly to 7.2 in sensitized hens one wk after the wattle challenge. Natural antibodies to mouse and rabbit erythrocytes were also affected by the wattle challenge. Anti-mouse titers rose from a prechallenge average log2 of 1.9 to 3.4. Anti-rabbit titers also rose from 4.8 to 6.7 during the same period. The net change in both types of natural antibody was about the same (1.7) for the two groups. Overall it appears as if total antibody output is balanced so that increasing one type is offset by decreasing or not changing another type. Thus changes in humoral immune output (natural and acquired antibody levels) accompanied the