211  Using sulfuric acid and aluminum sulfate to control litter ammonia emissions and Salmonella concentration. Z. T. Williams*, M. A. Bailey, and K. S. Macklin, Auburn University, Auburn, AL.

Litter ammonia emission and bacteria pathogen control are 2 major issues affecting the modern commercial poultry industry. Litter amendments have been developed that when applied to the litter surface will trap ammonia as ammonium and reduce volatilization. These amendments come in several types, with acidifiers being the most common. Past research has demonstrated that these amendments may also have some efficacy at reducing Salmonella. The results presented here describe 2 experiments using 2 chemical amendments; liquid sulfuric acid and a sulfuric acid derived granulated product, aluminum sulfate (alum). Amendments were applied to the surface of 3 kg of litter, in triplicate, at 3 different application rates; sulfuric acid at 9.8, 19.5 and 29.3 L/100 m²; Alum at 24.4, 48.9 and 73.1 kg/100 m². Litter also received a 30 mL cocktail of 5 poultry associated S. enterica serovars (Enteritidis, Heidelberg, Kentucky, Montevideo, and Typhimurium) at 9 log_{10} cfu/mL, giving a final concentration of 6 log_{10} cfu/g litter. Control litter treatment only included a Salmonella cocktail. Ammonia was measured before treatment and then every 24 h until the conclusion of the trials at 96 h. Both amendments were able to significantly reduce ammonia to acceptable levels within 24 h from application, <20 ppm (P < 0.001). Alum had no effect on Salmonella, while sulfuric acid reduced Salmonella to less than detectable number within 24 h, regardless of application rate (P < 0.001). Salmonella was recovered from the alum treated litter for the duration of the trial. Salmonella was never recovered from the sulfuric acid treated litter. The results indicated that both are effective ammonia reducers, but only sulfuric acid was indicated as an effective agent against Salmonella.

Key Words: Salmonella, ammonia, litter, amendment, acidifier

212  A comparison of four bedding sources for broilers. T. A. Lavergne*1, J. B. Schmidt2, L. R. Brunet1, J. W. Charal1, and L. A. Gaston1, 1Louisiana State University Agricultural Center, Baton Rouge, 2Louisiana Department of Agriculture and Forestry, Baton Rouge.

A comparison of 4 bedding sources was conducted in 3 flocks of broilers. A total of 4,200 mixed-sex Cobb 500 broilers were used. On d 0 of each flock, broilers were allotted to one of 4 bedding treatments in a completely randomized design. The treatments were (1) pine shavings (PS), (2) rice hulls (RH), (3) pelleted blend of recycled newsprint and recycled cardboard (PB), and (4) wood pellets (WP). There were 7 replicate pens of each treatment and 50 broilers per replicate in each flock. Each flock was reared for 42 d and fed a 3-phase commercial feeding program. There were no effects (P > 0.05) of bedding treatment on body weight, average daily gain, average daily feed intake, or feed efficiency in any flock. For each flock, litter moisture was lowest (P < 0.01) for WP, then for PB, and highest for PS and RH. Litter ammonium nitrogen was lower (P < 0.08) for WP and PB than for PS and RH. Litter total phosphorus, total dissolved phosphorus, and dissolved reactive phosphorus were lowest (P < 0.01) for WP, then for PB, and highest for PS and RH. Footpad dermatitis was not observed for any broilers on any treatment in any flock. PB and WP can be utilized as bedding for broilers and may have lower litter ammonium nitrogen, phosphorus, and moisture than PS or RH.

Key Words: bedding, pine shavings, rice hulls, wood pellets, broilers

213  Effects of litter reuse on measures of broiler performance and welfare in a commercial Australian production system. M. D. Cressman*1,2, S. J. Moeller1, S. W. Walkden-Brown1,3, and H. N. Zerby1, 1The Ohio State University, Columbus, 2Poultry CRC, Armidale, New South Wales, Australia, 3University of New England, Armidale, New South Wales, Australia.

Production costs and resource availability continue to pressure broiler producers to reuse poultry litter. Therefore, the objective of this study was to investigate the effects of reused litter on bird performance, welfare, litter pH and moisture, and air ammonia concentrations on 3 commercial broiler farms in New South Wales, Australia. On each farm, litter from the previous batch within 6 on-site sheds was assigned to one of 3 treatments: (1) a full cleanout replenished with new litter (NL); (2) litter reuse in the entire shed following heaping and turning (RL); and (3) RL plus the addition of an acidifying litter amendment (RL+A). In the RL and RL+A sheds, chicks were placed directly on reused litter. Mortality was recorded by farm staff. Live bird bodyweight (BW), welfare, and litter measurements were collected on d 0 (day of placement), 7, 14, and 35 and analyzed as a 3 × 4 factorial arrangement in a randomized block design with repeated measures in time using the PROC MIXED procedure of SAS version 9.3. Following heaping and turning, RL and RL+A litters were drier (P < 0.0001) than NL litter on day of placement, with no treatment differences occurring thereafter. The pH of NL was lower (P < 0.001) than RL and RL+A at 0 and 7 d. Observed early (2%) and final (6.5%) mortality rates were consistent with commercial production systems. Live bird BW did not differ between treatments on d 0, 7, or 14; however, by d 35, RL birds tended (P = 0.08) to be 102 ± 41 g and 145 ± 43 g heavier than NL and RL+A birds, respectively. Welfare measures provided no evidence of sustained reduction in welfare status of birds on reused litter, or any clear benefits or disadvantages of the litter amendment. The litter amendment failed to significantly impact litter chemistry, such that litter moisture and pH did not differ between RL and RL+A. However, litter amendment did appear to have a reducing effect on air ammonia concentrations relative to the RL treatment on 2 of the test farms. Under proper management, results indicate bird performance and welfare can be maintained when incorporating reused litter.

Key Words: broiler, litter reuse, welfare, performance

214  Effects of light restriction and stocking density on broiler performance and carcass quality. T. M. El-Sheikh*, Sohag University, Sohag, Egypt.

This investigation was conducted to determine the effect of light restriction and stocking density on growth performance of Cobb × Cobb broiler strain, body longer bones and carcass quality measurements. The experimental design was 3 × 2 × 2 (3 light treatments, 2 stocking densities and 2 replicates). The 3 light treatments were 23L:1D (control), 18L:6D (restricted 1), and 12L:12D (restricted 2) and the 2 stocking density studied were 10 and 12 bird per square meter. Body weight, feed efficiency, mortality rate were measured at 0, 21, 35, and 42 d of age, weight and length of shank, keel, and tibiotarsal at the end of the experiment. Ten birds from each treatment were used to bones and carcass quality measurements. Carcass quality was graded according to the presence of vent scabs, hip scabs and sores, the carcass which have one of them is not grad A. The results of this experiment showed that light restriction significantly (P < 0.05) decreased body weight (2410,
2350 and 2245.5 g for 23, 16 and 12 L, respectively) and feed consumption but significantly improved feed conversion. Weight and length of shank were significantly ($P < 0.05$) decreased by light restriction. While length and weight of keel and tibiotarsal were not significantly affected by the light restriction and stocking densities treatments. Low stocking density was the best for performance (2366.7 g body weight) and carcass quality and increasing carcass grade A (74%) compared with 2303.7 g body weight and 51% carcass grade A for high stocking density. There were an interaction between light restriction and stocking density, 12 birds/m² were good performance under light restriction (marketing body weight was 2380 g compared with 23L:1D (2320 g). The percent of carcass grade A was increased as light period increased while carcass grade A was increased with low stocking density.

**Key Words:** light restriction, stocking density, body structure, broiler, carcass quality

### 215 Effects of genotype and increasing daylength one week prior to market age on broiler productivity and reactivity

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The addition of darkness to a program can improve productivity, reduce mortality, and improve well-being of broilers. However, an issue for some producers is the higher activity levels in flocks with darkness exposure, particularly at time of catching. A study was conducted to assess the possibility of reducing activity at time of load out by increasing day length during the final week of grow-out, and further to determine changes in productivity resulting from this lighting change. Four genotypes (A, B, C and D), housed in 23 × 2.0 m pens, were grown under one of 3 day lengths from 4 d to market weight – 23L:1D (23L), 17L:7D (17L) or late increasing (17L:7D to 26 d then 23L:1D to 33 d) (L-INC).

A total of 7614 birds were used. As genotypes may be selected for various traits, differences were noted in the measured variables, including growth rate, feed efficiency, mortality, average foot pad lesion scores, meat yield and bird reactivity. With regards to lighting, 17L and L-INC birds were the heaviest at 33 d (2.185 and 2.195 kg versus 2.136 for 23L). Maintaining darkness to marketing (17L) resulted in the most efficient feed conversion (0.656) but not differences were found between lighting treatments. Lighting treatment did not affect major characteristics of meat yield, and no significant differences were noted between lighting treatments. Lighting treatment did not affect major characteristics of meat yield, including the percent of breast or dark meat. Birds raised under 23L reacted less to an observer from d 6 to 33. During the final week of grow-out, increasing day length to 23 h (L-INC) did not reduce bird reactivity as compared with 17L. To conclude, changing day length to 23L with the goal of reducing activity late in the production cycle was not effective, and resulted in poorer feed efficiency as compared with birds given 7 h of darkness to the end of trial.

**Key Words:** broiler, behavior, lighting, productivity, load out

### 216 Effect of paddock density on egg production and quality in a brown egg layer strain

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This study was conducted at the North Carolina Department of Agriculture and Consumer Services’s Piedmont Research Station to examine the effects of paddock density on production and egg characteristics in a single production cycle. This study consisted of 220 Hy-Line Brown hens which were selected as a good representation of hens used in extensive production systems. Four range hut pens provided a density of 1271 cm² (197 m²) at populations of 55 hens/pen with paddock dimensions of 18.3 m × 18.3 m (60 × 60 ft) for a density of 3.04 m²/hen (32.7 ft²/hen) vs. 9.2 m × 9.2 m (30 ft × 30 ft) for a density of 0.77 m²/hen (8.2 ft²/hen) rotated every 28 d. The primary objective was to provide an unbiased comparison of the paddock density. Hen day egg production was not affected by the paddock hen density, with 84.71 vs. 84.37, respectively to 0.77 and 3.04 m²/hen. It was observed that the feed intake/hen ($P = 0.0382$) was 113 g/hen when submitted to high density, and the ones submitted to low density was 110 g/hen. Therefore, the feed efficiency observed (g egg/g feed), was improved by 2.08% ($P < 0.02$) for the hens in high paddock density. The overall mortality was not significant at 17.27 and 13.64% in the paddock densities 0.77 and 3.04 m²/hen, respectively. There were no differences in USDA grade A, or in bloods and checks between the paddock densities however, hens in the low density paddocks produced 5.22% more large eggs ($P < 0.01$) than the high density counterparts. In conclusion, the Hy-Line Brown hens provided the low density paddock had better feed efficiency and improved large egg size. The increased forage availability in the low density pen appears to have contributed to improved feed conversion.

**Key Words:** Hy-Line Brown, paddock density, free range, laying hens

### 217 The effect of microwave toe trimming on heavy tom production

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Three hundred 6 male Hybrid Converter poult’s were either trimmed (T) or not trimmed (UT) at a commercial hatchery to determine the impact of microwave claw processor (MCP) treatment on heavy tom production. Each treatment was replicated 9 times with 17 birds per pen. Poults were reared on litter floors at a stocking density of 34 kg/m². Body weight and feed intake were measured on d 0, 7, 21, 42, 56, 70, 91, 126 and 140, and all mortality was submitted for necropsy to determine the cause of death. Toe length was determined on d 55, 84, 119 and 139 to assess degree and variability of toe trimming. Toms were marketed at 140 d, with 45 carcasses from each treatment examined for carcass scratches and other damage. Feed consumption was greater for UT birds from 0 to 7 and 126–140 d. UT toms weighed significantly more than T toms at 91, 126 and 140 d, with UT turkeys being 0.55 kg heavier than T birds at processing. There were no differences in feed efficiency or total mortality for T and UT toms, though there was more culling for rotated tibiae in T (3.27%) compared with UT birds (0.65%). Toe length for T toms was 91.7–92.6% of the UT length. Carcass damage due to scratches, breast blisters and buttons, broken bones and bruising was not affected by toe trimming. Due to the reduced body weight at processing and higher incidence of rotated tibia, along with no improvement in carcass condition, the results from this study suggest toe trimming for heavy tom production is not required.

**Key Words:** microwave toe trimming, heavy tom, turkey production, carcass quality

### 218 Research in the real world: Combining commercial field research and extension

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The Alberta hatching egg industry has had low egg numbers and hatchability relative to the rest of Canada since 2005. A field study was designed to identify management strategies that improve chick production, which include effective data use. Producers have many data and information sources to guide decision making; their own flocks, hatchery reports, technical personnel, research results and breeder management guides. Breeder performance objectives are benchmarks against which individual flock performance may be measured, while information resources equip innovation on individual farms. The study was designed to see how producers used data and other information sources to manage their flocks and how Alberta flocks performed relative to breeder objectives. One flock on 14 farms was visited 8 times between placement and depopulation. Chick production, feed samples and observations of management practices were collected. Standardized reporting forms were developed for producers to share data with the research team. A commercial laboratory measured crude protein and calculated energy levels. Farms were ranked according to flock productivity, as measured by the standard Alberta metric: number of chicks per pullet placed (CPP). The mean number of CPP for study farms was 105.8 and ranged from 120.8 to 90.2; the provincial mean CPP during the same period was 104.3. Performance relative to the following breeder objectives was determined for each flock to 59 wk: liveability (87%), feed/100 chicks (36.2kg/100 chicks) and calculated cumulative protein (7.2kg) and energy (135769 kcal) allocations. The top study flock had liveability 93.9%, compared to the lowest ranked flock at 88.0%. The top flock achieved superior chick numbers with less feed than the lowest flocks; 38.0 vs 53.1kg/100 chicks, respectively. Feed amounts may have differed based on feed quality. Target protein and energy levels were exceeded by all flocks in the study. Successful chick production is associated with close adherence to breeder objectives, with liveability being a key measure of success, followed closely by efficiency of feed formulation and allocation.

**Key Words:** breeder, liveability, protein, energy, performance objective