Animal Behavior and Well-Being: Poultry 1: Ducks, Layers, and Turkeys

253 Who did it and why: Floor laying by Pekin ducks. M. M. Makagon* and J. A. Mench, *University of California, Davis*.

Floor eggs, which are eggs laid outside of nest boxes, are a common problem in poultry production systems. We investigated factors contributing to the laying of floor eggs by Pekin ducks. In a 2 × 2 factorial design, 16 groups of 18-wk-old ducks (8 per group) were provided access to either 2 or 8 closed-topped or open-topped nest boxes in their pens. Egg locations were recorded daily for 16 weeks following nest box introduction. Video analyses were used to determine the sources of a sample of floor eggs laid during wk 1–4, 8, 12 and 16. An analysis of nontoxic dye deposition in the egg yolk was conducted on wk 12, 14 and 16 to determine each duck's contribution to floor laying. Repeated measures ANOVA revealed that the proportion of floor eggs decreased over weeks ($F_{3,9}$ = 29.29, P < 0.0001), and was greater among the groups with only 2 nest boxes ($F_{1,11}$ = 24.09, P = 0.0005), but was not affected by nest box design ($F_{1,11}$ = 0.08, P = 0.776). Not all available nest boxes were used on a given day. In 8-box pens, for example, on average only 3 to 4 boxes were used per day. Of the 202 floor eggs identified on video, 65% were laid in the 4 h after the lights went on (0300–0700). This corresponded to the time of highest nest box use and competition. However, 32% were laid during the dark phase (2100–0300) when nest box activity and competition were low, and 1% were laid in the afternoon. The remaining 2% of floor eggs were ejected from nest boxes by the ducks. Yolk stain analysis indicated that 67% and 52% of ducks housed with 2 and 8 boxes, respectively, laid floor eggs, although none laid exclusively on the floor. Taken together these results suggest that floor laying by Pekin ducks may in part be a product of competition for nests, and can be decreased by optimizing the nest box to duck ratio. However, since 33% of floor eggs were laid during periods of low competition and not all boxes were used each day, other factors probably also contribute to the problem.

Key Words: nesting behavior, domestic duck, floor eggs

254 Nest choices of Pekin ducks. M. M. Makagon*, C. B. Tucker, and J. A. Mench, *University of California, Davis*.

To encourage nest use by breeder flocks, it is important that nest boxes are attractive to hens. Few studies have evaluated factors affecting nest attractiveness and nest choices of ducks. We assessed the effects of nest box experience and features of nests on nest site selection by sexually mature Pekin ducks. Hens were tested individually in pens containing different nest box choices. Nest preferences were determined based on the locations of 14 successively laid eggs. Experiment 1 assessed the effects of nest box experience and degree of nest enclosure. Ducks (n = 24) were reared with access to either open-top (OP) or closed-top (CL) nest boxes. They were then allowed to choose between 4 nest boxes varying in level of enclosure: OP, CL, OP with a nest curtain (OP-C), or CL with a nest curtain (CL-C). Ducks laid twice the expected proportion of eggs in the CL-C boxes (t_{22} = 4.21, P = 0.0004), demonstrating a preference for a high level of enclosure that was independent of previous nest box experience (t_{21} = 0.65, P = 0.53). CL boxes were used as predicted by chance (t_{22} = −0.33, P = 0.746), while OP and OP-C contained only half the expected number of eggs (OP t_{22} = −2.64, P = 0.015; OP-CL t_{22} = −2.86, P = 0.009). Experiment 2 assessed the effect of the presence of an egg in the nest. Ducks (n = 24) were provided with 2 nest boxes, one of which contained a single egg from the previous day. Each day, the newly laid egg was marked and either placed back in the nest box where they were found (Handled) or moved into the adjacent nest box (Moved). Handled and Moved ducks laid 97.6% and 79.8%, respectively, of their eggs in boxes containing the previous day's egg. While ducks in the Handled group were consistent in their choice throughout the test, those in the Moved group developed this preference over time (Wilcoxon S = 17.5, P = 0.039), suggesting that the preference for laying in a nest containing an egg may be influenced by experience. These results indicate that nest box enclosure and the presence of an egg are important in determining the nesting choices of Pekin ducks. Incorporating these features into nest boxes may be useful for increasing consistency of nest use by breeder flocks.

Key Words: Pekin duck, nest site selection, nest design

255 The effect of human induced stressors on the vocalizations of commercial brown and white egg laying hens. E. Otu-Nyarko*[1], J. An[3], P. M. Scheifele[2], D. B. Miller[1], M. T. Johnson[3], and M. J. Darre[1], [1]*University of Connecticut*, *Storrs,* [2]*University of Cincinnati*, *Cincinnati, OH,* [3]*Marquette University*, *Milwaukee, WI*.

A study was conducted at a commercial cage layer poultry farm in Connecticut to determine the effect of human induced stressors on the vocalizations of brown and white egg layers of various ages. Vocalizations and behavioral data were collected from 13 groups of 320 hens per group. A uni-directional Shure 10L Prologue microphone with a frequency sensitivity of between 20Hz and 15,000Hz was connected to a Compaq laptop computer with Cool Edit Pro 2.0 sound analysis software to record and edit vocalizations. A Hidden Markov Model modified for use as a speech recognition algorithm and statistical tool was used to classify the vocalizations. The accuracy of the classification was determined using a confusion matrix. Three different human induced stressors were applied to them. These were abrupt noise, touch, and walking through the coop in front of the birds. Non-stressed vocalizations were also obtained for comparison with the treatments. Of the entire vocalization spectral envelope, the Greenwood Function Cepstral Coefficients were extracted for the determination of the level of accuracy with the classification of vocalization using the modified Hidden Markov Model and a confusion matrix. It was found that the non-stressful vocalizations were significantly different ($P \leq 0.05$) from the stress induced vocalizations for both breeds with classification accuracy of 77% and 75% for white and brown egg layers respectively. For the stress induced vocalizations there were significant differences in vocalizations made as a response to abrupt noise, touching, and walking through the coop at an accuracy level of 81.2%, 74.29% and 36.3% respectively with abrupt noise being the most stressful to the chickens, resulting in the most recognizable and repeatable vocal response. Both breeds at peak production (28–29weeks) had similar vocalizations under all the conditions as indicated by a lower accuracy of about 64% in comparison with all other age groups for both stress-induced and non-stressed vocalizations. The brown egg strain was less susceptible (89%) to the effect of the stressors than the white leghorn laying hens (92%).

Key Words: vocalization, stress, hidden Markov model

256 Influence of environmental management methods on the expression of glucocorticoid receptors in the laying hen's ovary. D. V. Arbona*, L. A. Bola, and J. B. Hoffman, *North Carolina State University*, *Raleigh*.

In commercial egg production, increasing public scrutiny regarding the welfare of laying hens has led to the development of alternative manage-

ment practices including free-range housing in addition to conventional battery style cages. To ascertain the effects of layer housing management methods on ovarian susceptibility to corticosterones via expression of follicular glucocorticoid receptors (GR), ovarian follicles were collected from 6 Hy-line brown layers reared in a free-range system with access to a forage covered area divided into 4 paddocks as well as an enclosed range hut with feed, water, and nests. For comparison, ovarian follicles were collected from 6 Hy-line brown layers reared in conventional battery style cages stacked directly on top of one another with troughs for feed and nipple waterers. Separated granulosa and theca tissues from the F1-F4 hierarchical, and combined granulosa and theca tissues from the small yellow and large white non-hierarchical follicles were collected by manual dissection for GR characterization. Characterization of the GR in the ovarian tissues was performed following Total RNA extraction followed by 2-step real-time PCR. Relative quantification of the GR was completed using the $\Delta\Delta C_T$ method and data was expressed as the fold-difference relative to the F1T sample. Differences in the expression were determined by ANOVA using the GLM procedure ($P < 0.05$). No significant differences in non-hierarchical follicular GR expression were noted between free-range (0.69 ± 0.11) vs. battery style hens (0.75 ± 0.16) ($P < 0.05$). However, total GR expression in the hierarchical follicles was significantly higher in the free-range hens (1.35 ± 0.05) compared with the battery style hens (0.69 ± 0.04) ($P < 0.001$). These observations combined with previous data showing significantly decreased production of grade A eggs by free-range hens suggest that the free-range environment may negatively influence reproductive fitness due to differences in follicular stress susceptibility caused by altered glucocorticoid receptor expression.

Key Words: glucocorticoid receptor, free-range, battery cages

257 The influence of cage housing system and laying hen strain on bone quality pre and post slaughter. A. McMillan[1], K. Juurlink[1], B. Rathgeber[2], and M. Jendral*[1], [1]*Nova Scotia Agricultural College*, *Truro, Nova Scotia, Canada*, [2]*Agriculture Agri-food Canada*, *Truro, Nova Scotia, Canada*.

The influence of cage housing system and laying hen strain on bone quality traits pre and post slaughter was determined for 3 strains of laying hens (Shaver White (SW), Lohmann Lite (LL), Lohmann Brown (LB)) housed in conventional cages, and furnished colony units, and processed under commercial conditions. During the laying period, hens were either housed in conventional cages (60cm × 45cm) (n = 24 cages per strain; 5 hens per cage) or furnished colony cages (240cm × 110cm) (n = 12; 4 per strain; 40 hens per cage). Furnished cages contained a nestbox (60cm × 55cm), 3 hardwood, semi-circular perches (240cm × 5cm) and a dustbathing facility (60cm × 20cm). At 80 weeks, all hens were palpated before slaughter to assess fractures to the furculum, keel, humerus, radius, ulna, femur, tibia and pubis bones. Post slaughter (no evisceration), 25 randomly selected hens per colony cage, and all 5 hens in 9 randomly selected conventional cages per strain were re-palpated for fractures of the above bones. Additionally, right femur, tibia and humerus bones were isolated from 6 randomly selected hens per colony cage and all 5 hens in 9 conventional cages per strain and frozen for later analysis of bone densitometry and breaking strength. Conventionally caged hens exhibited higher incidence of pre slaughter humerus and radius fractures ($P < 0.05$). Furculum breaks occurred most frequently post slaughter; however, no treatment or strain differences were determined for the furculum. LL and LB hens exhibited fewer wing and leg breaks pre and post slaughter ($P = 0.05$), however LL hens exhibited the highest incidence of keel fractures before slaughter. These results indicate that bone fractures throughout the laying period and at processing are more common in conventionally housed laying hens, and that strain differences are apparent.

Key Words: laying hen, bone quality, furnished cages

258 Astroturf as a dustbathing substrate for laying hens. G. Alvino*, G. Archer, and J. Mench, *University of California*, *Davis*.

During dustbathing bouts, birds distribute a friable substrate like sand through their feathers. This behavior helps to maintain good plumage condition and hence the insulative value of the feathers. Many designs of furnished cages for laying hens contain a dustbathing area comprised of an Astroturf (AT) pad, which may be sprinkled with feed with the intent of promoting both foraging and dustbathing. We evaluated the behavior of hens exposed to AT or AT plus feed to determine if these substrates stimulate dustbathing. Hy-Line CV20 laying hens (n = 30) that had no prior exposure to friable substrate were housed singly in 91.4cm x 45.7cm x 45.7cm cages beginning at 34 weeks of age. Groups of 10 hens were randomly provided with either sand (control); a 33 × 36.5cm AT pad; or an AT pad of the same size covered each day with 200 g of laying hen feed (ATF). After the hens had been exposed to these substrates for 17 d, behavior was video recorded from 0600 - 2200 h (photophase duration). Data were analyzed using Kruskal-Wallis and Dwass-Steel- Critchlow- Fligner non-parametric tests. There were significant differences in the total number of dustbathing bouts ($H_2 = 8.21$, $P = 0.017$), with control hens performing fewer bouts (mean = 3) than AT (13); ATF were intermediate (6). The proportion of bouts performed on substrate ($H_2 = 13.94$; $P = 0.001$) and the wire floor of the cage ($H_2 = 12.68$; $P = 0.0018$) differed, with the control hens that dustbathed performing a higher proportion in substrate (1.0) and a lower proportion on wire (0) than both AT (0.13; 0.87) and ATF hens that dustbathed (0; 1.0). There were also differences in total time dustbathing on wire ($H_2 = 12.32$, $P = 0.002$) and substrate ($H_2 = 9.32$, $P = 0.010$), with control hens dustbathing for significantly less time on wire (mean = 0 min) than both AT (26) and ATF (28) hens and significantly more time on substrate (19) than ATF hens (0). These findings need to be confirmed with additional observations, but suggest that an AT pad does not provide an adequate substrate even with feed added, since hens with AT dustbathe mainly on the wire floor of the cage rather than on the AT.

Key Words: Astroturf, sham dustbathing, chicken

259 The behaviour of laying hens in commercial aviary systems. M. P. de Villareal*[1] and I. Estevez[1,2], [1]*Neiker-Tecnalia*, *Vitoria-Gasteiz, Spain*, [2]*IKERBASQUE*, *Bilbao, Spain*.

Here we present preliminary results of a larger ongoing study in which we compare the behavior of laying hens maintained under different production conditions. For this part of the study, data were collected by video footage in 7 single tier aviary commercial farms with and without access to an outdoor park. Flock sizes ranged between 6,000 to18,000 birds. The lines used were Bovan brown, ISA brown, and Lohman white. Video recordings took place from 7.00 to 9.00, 11.00 to 13.00 and 17.00 to 19.00 for morning, midday and afternoon periods. Video sequences were imported into the software The Observer for visualization and analysis. From the recordings, behavioral time budgets and frequency of transitions, defined as the number of behavioral changes per unit of time, were obtained by continuous focal sampling of 3 randomly chosen hens in each video sequence. Data were standardized according to sequence duration. Means per farm, week and time period were calculated and used for statistical analysis, a mixed model repeated measures ANOVA (SAS, V 9.1). Results indicate differences in time budgets across layer line and housing system ($P < 0.01$), but

no effect of time period was detected ($P > 0.05$). Interactions across factors were non significant ($P > 0.05$). Lohman whites had the highest proportion walking and foraging whereas standing was most prominent in Bovan and ISA brown. Problematic behaviors such as aggressive pecks, threats and feather pecking were unusual events for all lines. The differences according to systems were important with higher frequencies of standing and foraging observed in aviaries without access to parks, and higher proportions of resting and less standing and foraging observed in free range. Behavioral transitions varied according to hen type and housing system only ($P < 0.05$). In conclusion, across strains the Lohman white hens were the most active, however no differences were detected related to problematic behaviors such as aggressive or pecking behaviors. Contrary to expectations, birds with access to an outdoor park were less active when indoors as compared with birds in aviaries without access to parks.

Key Words: laying hens, behavior, aviary systems

260 On-farm survey of beak characteristics in White Leghorns as a result of hot blade or infrared beak trimming. T. Gabrush[1], C. Carruthers*[1], K. Schwean-Lardner[1], T. Knezacek[1], C. Bennett[2], and H. L. Classen[1], [1]*University of Saskatchewan*, *Saskatoon, SK Canada*, [2]*Manitoba Agriculture, Food & Rural Initiatives*, *Winnipeg, MB Canada*.

Treating the beaks of White Leghorns is a common practice used primarily to reduce cannibalism. However, opposition to this procedure is based partially on the assumption that trimming may cause deformities, inhibiting the ability of hens to eat and perform normal behaviors. Infrared (INF) systems are currently becoming more prevalent in industry, replacing hot blade (HB) beak trimming. This on-farm survey examined the effects of HB or INF treatment on beak characteristics in commercial flocks. Hens on 3 farms were observed between 21 and 24 and between 53 and 60 weeks of age. Two farms housed hens of the same strain that had been HB trimmed at the hatchery while a third housed 2 strains that had been INF treated at the hatchery. Overall, 91% of the beaks measured were 10.0 to 13.9 mm in length, approximately 52 to 73% of the expected length of an intact beak. The remaining hens had beaks less than 10 mm (4%) or ≥14 mm (5%). HB trimmed beaks averaged 12.36 mm (SEM = 0.060) and 12.40 mm (SEM = 0.063) at 21–24 weeks of age, and 12.39 mm (SEM = 0.064) and 12.80 mm (SEM = 0.071) at 53–60 weeks of age. INF trimmed beaks averaged 11.33 mm (SEM = 0.058) and 11.14 mm (SEM = 0.043) at 21–24 weeks of age, and 12.03 mm (SEM = 0.053) and 11.35 mm (SEM = 0.059) at 53–60 weeks of age. Deformities were observed at low frequencies, and included abnormal re-growth (7.42%), blisters (0.54%), cracks (3.50%), angled beaks (not perpendicular; 2.88%) and cases where the bottom beak was longer than the top (BLTT) (11.63%). Although a direct comparison between HB and INF trimming was not possible because the hens were of different strains and were housed in different environments, cracks and abnormal re-growth were observed more frequently in HB (6.58% and 11.42%, respectively) compared with INF trimmed hens (0.42% and 3.42%, respectively). HB and INF treatment resulted in similar beak lengths and characteristics, however comparisons of treatment type within strain and environment is warranted.

Key Words: cannibalism, feather pecking, welfare

261 Effects of different infrared beak treatment protocols on chicken welfare and physiology. R. L. Dennis* and H. W. Cheng, *LBRU, USDA-ARS*, *West Lafayette, IN*

Infrared beak treatment (IR) provides an alternative to conventional hot blade beak trimming (HB), which purports to be more welfare friendly. To improve the efficiency of the IR system, different interface plates (25/23C and 27/23C) and lamp power settings (44, 48 and 52) were tested in this study. Infrared beak treatment was conducted at the hatchery and HB was performed at 7 to 10 d of age in a commercial setting. Physiological and behavioral measures were taken at 5, 10, 20 and 30 weeks of age after beak trimming (BT). Although all birds followed a similar growth curve, IR birds using 27/23C-48 protocol were the heaviest at 10, 20 and 30 weeks of age. Alternately, birds using the 25/23C-44 protocol were the lightest at 20 and 30 weeks of age. Upper and lower beak growth curves were also established showing birds trimmed with 25/23C interface plates to have a shorter upper and lower beak compared with 27/23C or HB trimmed birds. Birds trimmed using 27/23–44 and −48 consistently had the longest upper and lower mandibles among all birds. Feed wasted was greatest in HB and 27/23C-52 birds and tended to be less than HB in 27/23–48 and 25/23–48 and −52 trimmed birds ($P < 0.10$). Behavior analysis revealed that birds treated using 27/23C protocols walked and drank more than HB birds ($P < 0.05$). Feather scores (FS; scored 0–5; 0 = perfect plumage and 5 = bare with skin damage) taken at 20 and 30 weeks showed higher breast FS in HB and 25/23C-44 birds compared with 27/23C birds ($P < 0.05$). Back FS was the highest in 25/23C-48 birds compared with the birds trimmed using HB or other IR protocols ($P < 0.05$). At 5 and 10 weeks of age, 27/23C-44 and −48 birds pecked significantly more at the novel object (a synthetic feather) than the birds trimmed using HB or other IR protocols ($P < 0.05$). However, HB and 25/23C birds had the highest synthetic feather damage score (scored 0–5; 0 = no damage and 5 = completely stripped shaft; $P < 0.05$). Our data show evidence that welfare and traits affecting feed efficiency can be improved with IR over HB in laying hens and that the IR protocol used can be adjusted to optimize these measures.

Key Words: beak trim, infrared, laying hen

262 Brain and skull lesions in turkeys resulting from non-penetrating captive bolt, cervical dislocation, cervical crushing and blunt trauma. M. A. Erasmus*, P. V. Turner, S. G. Nykamp, and T. M. Widowski, *University of Guelph*, *Guelph, Ontario, Canada*.

Previously, live observations of brainstem reflexes and time to death were conducted on different weight classes of turkeys to assess the effectiveness of on-farm killing methods. Three experiments were conducted: 1) a non-penetrating captive bolt (Zephyr) and cervical crushing were examined in turkey hens (11.4 ± 0.1 kg) at a research facility; 2) the Zephyr and blunt trauma were examined in turkey toms (13.1 ± 0.2 kg) at 2 commercial farms; 3) the Zephyr, blunt trauma and cervical dislocation were examined in broiler turkeys (4.1 ± 0.3 kg) at a commercial farm. Immediate insensibility resulted when the Zephyr or blunt trauma were used, but not with cervical crushing or cervical dislocation. Based on these results, the objectives of the present study were to assess brain damage resulting from the different killing methods. The severity of skull fractures and subcutaneous and subdural hemorrhage was assessed using post mortem macroscopic scores. Samples in each weight category were submitted for CT scans and histology. Macroscopic scores were compared among treatment groups using a mixed model (Expt. One and 2) and general linear model (Expt. 3); subcutaneous hemorrhage was greater with the Zephyr (Hens: $F = 27.8$, $P = 0.01$; Toms: $F = 5.4$, $P = 0.02$; Broilers: $F = 11.6$, $P = 0.0003$) and skull fractures were more severe for toms and broilers killed with the Zephyr vs. blunt trauma (Toms: $F = 65.0$, $P < 0.0001$; Broilers: $F = 5.4$, $P = 0.03$). Subdural hemorrhage was present in all turkeys regardless of treatment. Microscopic brain damage was present in all turkeys killed with the Zephyr and blunt trauma, but only 1 of 4 turkeys killed with

cervical crushing and 1 of 4 turkeys killed with cervical dislocation. The Zephyr and blunt trauma likely caused death by directly disrupting brain function, whereas cervical crushing and cervical dislocation likely resulted in death from cerebral hypoxia and ischemia. Based on tests of sensibility and post mortem investigations into the degree of brain damage produced, the Zephyr and blunt trauma appear to be effective and humane for on-farm killing of turkeys.

Key Words: turkey, brain damage, humane killing