

Behavior and Well-Being: Behavior and Well-Being

200 Behaviour and welfare of laying hens in conventional and modified battery cages. M. J. Jendral*¹, J. S. Church², and J. J. R. Feddes¹, ¹*University of Alberta, Edmonton, AB, Canada*, ²*Alberta Agriculture, Food and Rural Development, Edmonton, AB, Canada*.

The welfare of White Leghorn hens housed in conventional (CON) and modified (MOD) battery cages was assessed by evaluating behaviour during the laying period. CON (30x45cm) (n=84) and MOD (60x45cm) (n=84) each provided 450cm² of floor space for 3 hens. MOD included a perch (30x5cm) and a nest box (NB) (24x45cm), providing an additional 360cm² of nest area per bird. Location of lay was assessed for MOD on 2 consecutive d, every 4 wks, between 20 and 64 wks. Continuous video footage of 8 randomly selected cages per treatment was recorded at 35 and 60 wks, beginning at 0630 h. Focal sampling of each hen in the cage was conducted for 3 h, beginning as early as 0630 h, but extending at least 40 min beyond oviposition. Pre-lay, stereotyped, comfort, aggressive and resting behaviours, and hen location were recorded, and behavioural frequency (F), %-duration (PD) and mean duration (MD) were calculated. Data were analyzed using GLM for mixed effects. Treatment effects were significant at P≤0.05. NB use for oviposition was consistent throughout the study (m=94%). Behavioural observations indicate significantly higher PD of escape and bobbing activity in CON (P=0.05). F and PD of object pecking bouts were numerically higher in MOD, but occurred primarily in the NB. PD and MD of preening activity were significantly higher (P=0.03) in back and tail regions and numerically higher in belly and inside wing areas in MOD, and numerically higher in breast and outside wing regions in CON, suggestive of displacement preening in CON. F and PD of feather ruffling, head scratching and stretching were numerically higher in MOD. In CON, F and PD of aggressive pecking bouts and displacement, and feather pecking bouts were numerically and significantly higher (P=0.05), respectively. CON birds spent numerically more time standing and less time sitting and dozing. These findings suggest that hen welfare was improved in MOD, since hens preferred to oviposit in the NB, and CON hens experienced increased frustration and aggression, and reduced comfort and rest. Modifications to conventional battery cages improve hen welfare, while allowing producers to make use of existing capital.

Key Words: laying hen, behaviour, welfare

201 Benefits of environmental complexity for broiler breeders. E. H. Leone*, I. Estevez, and K. Spahn, *University of Maryland, College Park*.

Good management practices are critical to maximize reproductive performance in broiler breeders. Yet we know little about what goes on in commercial facilities. Females commonly congregate on the slats to avoid harassment from males gathered mainly in the litter area. Male harassment may result in poor fertility and a high incidence of female injury and mortality. Increasing environmental complexity with cover panels may help alleviate this problem by attracting females to the litter area. Additionally cover panels may increase space use by males, resulting in greater mating opportunities, reduced mating interference and increased reproductive performance. We conducted a demonstration study on five commercial broiler breeder farms to determine the potential benefits of cover panels. Each farm had a

control and panel treatment house with approximately 7000 females and 800 males. Flocks were studied until 51 weeks of age. Reproductive performance was measured by number of eggs laid/female and their hatchability. Male movement was measured by recording the location of ten randomly marked individuals in each house for ten weeks. Home range analysis was performed using minimum convex polygons as well core areas at 95% probability. Increased environmental complexity did not significantly impact female mortality (P > 0.05) or eggs laid (P > 0.05) but increased hatchability (P < 0.05) and decreased percent floor eggs (P < 0.05). Male home ranges measured by minimum convex polygon were larger for the cover panel treatment over the control (P < 0.05); difference between core areas was non-significant (P > 0.05). There was however a higher degree of variability (P = 0.05) between males' core areas in the panel treatment, ranging from 34 to 100% usage of the total available space. These results suggest that cover panels have a positive impact on hatchability, perhaps due to increased mating opportunities and/or reduced females stress, and allow males a wider expression of use of space patterns. These results suggest that for broiler breeders environmental enrichment may not only be beneficial for the birds but may also be economically sound resulting in a win-win situation.

Key Words: broiler breeders, cover panels, performance

202 Development of a high-throughput modified atmosphere chamber for the on-farm euthanasia of spent hens. J. S. Church*, N. J. Cook, D. B. Haley, and D. Slingerland, *Alberta Agriculture, Food and Rural Development, Edmonton, AB, Canada*.

A new High-Throughput Modified Atmosphere Chamber (HT-MAC) was developed at the Agri-Tech Centre in Lethbridge, Alberta. The HT-MAC was field tested in Alberta at the Rose Dale Colony on March 17, 2005. The HT-MAC unit consists of a large plastic bin, approximately 1.83 m by 1.22 m by 1.22 m, with a hinged lid. A hole is cut in the lid and covered by an aluminum hood with a hinged front flap; birds are put into the bin by pushing open the flap and dropping them into the bin. Bin loads contained 436.2±27.0 (mean±SD) birds. The rate at which the cart was filled was 71.5±18.5 (mean±SD) birds/min. The bin has a PVC pipe mounted in each corner, with each pipe having small holes drilled along the length. These pipes are connected together on the bottom, and capped at the top. A hose is routed from this system to a quick-coupler mounted on the outside of the bin, and the gas supply is connected to this system via the quick-coupler when the bin is in use. The gas (CO₂) is supplied from a liquid dewar; to obtain a high enough rate of gas, the CO₂ is taken from the dewar as a liquid and run through a vaporizer to produce the gas needed to fill the bin. The vaporizer is a modified hot water tank, filled with a water/antifreeze mixture and heated by propane. The CO₂ runs through coils of copper tubing installed inside the tank. A regulator on the outlet of the vaporizer controls the gas rate. The bin is mounted within a u-shaped frame that attaches to a skid-steer. The skid-steer is used to move the bin around, and if necessary to lift it for dumping into a truck or onto a pile. Including 10 min to prime, fill and unload each bin and 436.2 birds in each bin we calculate a total culling rate of 3,450 birds/h at this location.

Key Words: layers, culling, euthanasia

203 Barley silage effects on laying hen behaviour. S. G. Johannson*, K. V. Schwean-Lardner, and H. L. Classen, *University of Saskatchewan, Saskatoon, SK, Canada.*

Feather pecking is a common behavioural vice which can lead to a number of problems within a flock of chickens such as cannibalism and decreased welfare. Recognizing that nutrition can affect poultry behaviour, it was of interest to investigate the use of an alternate feed ingredient to reduce feather pecking in laying hens. Two experiments, each consisting of two treatments with four replications, were conducted to observe the effects of providing ad libitum access to barley silage on aggression and feather pecking behaviour in laying hens from 19-28 and 20-30 weeks of age, respectively. Each colony cage housed 20 hens and 2 roosters. Both bird treatments were provided ad libitum access to a nutritionally balanced laying diet and a large particle calcium source (Sure Shell) while treatment birds also had access to barley silage. Colony cages were used having previously been shown to elicit severe feather pecking. Solid partitions were placed between each cage to prevent social learning of feather pecking behaviour. Behavioural observations were collected via scan sampling on a bi-weekly basis. Silage intake was measured daily whereas mash and Sure Shell intakes were collected weekly. Feather scoring and blood collection, measuring heterophil to lymphocyte ratios, were completed at trial end. Treatment birds readily consumed silage with an average as is and dry matter intake for combined experiments of 45 and 14 g/b/d. Control birds ate more mash than the treatment birds but the total dry matter intake of the treatment birds was slightly higher (93.27 vs 89.68 g/b/d). Birds from both treatments ate approximately the same amounts of Sure Shell. Feeding silage significantly reduced both aggressive and feather pecking behaviours. Total feather scores of the treatment birds measured 17.3 and 17.9 vs control birds 13.5 and 16.7 for experiments one (P=0.06) and two (P=0.21) respectively. Treatment did not affect H:L ratios in hens (0.17 vs 0.16) however, males housed in the control cages (0.15 vs 0.09) elicited higher H:L ratios. Ad libitum feeding of silage reduced feather pecking and aggressive behaviour and may serve as a potential aid in improving bird well-being.

Key Words: feather pecking, barley silage, behaviour

204 The effect of daylength on the behaviour of broiler chickens. K. Schwean-Lardner*¹, H. L. Classen¹, and B. I. Fancher², ¹*University of Saskatchewan, Saskatoon, SK, Canada,* ²*Aviagen Inc., Huntsville, Alabama.*

Behaviour can be an important component in assessing welfare in animals. An experiment was conducted to examine the effects of two levels of daylength on the behaviour of broiler chickens. Ross x Ross 308 males were exposed to photoperiod treatments of 14L:10D or 23L:1D from 7 to 32 d. Birds were housed in pens (N=15) with 2 rooms per lighting program, and given ad libitum access to feed and water. Using infrared digital video surveillance equipment, behaviour was recorded for 24 h at 25d of age. Data was then scan sampled at an interval of 10 min for the 24 h period. Behaviours recorded included resting, walking, standing, preening, leg or wing stretch, feeding, drinking, aggression, foraging, and dustbathing. Birds exposed to 14L:10D per day showed a clear separation between night and day in percentage of birds seen resting (P=0.052), walking (P=0.058), running, standing, feeding, drinking, foraging, and dustbathing. In birds exposed to 23L:1D, significant differences were noted between dark and light periods in resting, standing, feeding, and drinking,

although the numbers were much closer than seen in 14L:10D birds. During the daylight phase, differences between the two lighting treatments were seen in resting (P=0.09), running, standing, drinking, foraging, and dustbathing. Over the entire day, birds raised on 14L:10D spent significantly more time running, standing, foraging and dustbathing. They also spent 58% more time walking than birds on 23L:1D. In conclusion, birds raised on 23L did not have clear separation between night and day for some behaviours, and comfort behaviours were performed less often. Daylength affected broiler behaviour both during the photophase as well as the total activity over a 24 h period of the day.

Key Words: broiler, behaviour, photoperiod

205 Effect of photoperiod on mobility and leg defects in broilers. K. Schwean-Lardner*¹, H. L. Classen¹, and B. I. Fancher², ¹*University of Saskatchewan, Saskatoon, SK, Canada,* ²*Aviagen Inc., Huntsville, Alabama.*

Two experiments (E1 and E2) utilizing 4464 and 2976 broilers were conducted to determine the impact of photoperiod on the mobility and incidence of skeletal defects in broilers. In each experiment, two strains of commercial broilers (G) were housed sex-separately (S) and exposed to one of four lighting programs (23, 20, 17, or 14h; L) initiated at 7d of age. L treatments were replicated twice in each experiment and each S x G subclass was replicated 3 times within each replicate. No interactions were found between main effects and only L main effects are reported in this abstract. Mobility was assessed by gait scoring at 35 and 47d of age in E1, and at 34d of age in E2, with 40 birds per L x G x S grouping assessed at each age. Birds were visually assessed for ability to walk, within a scale of 0 (walking normal) to 5 (immobile). Combined mortality and morbidity necropsy results were summarized for skeletal defects over the 7-39d and 7-49d periods in E1, and from 7-38d in E2. Overall, gait scores were lower in all treatments than many previous reports, suggesting successful selection for improved skeletal quality. In E1, the relationship between average gait score and daylength at 35d was linear (0.73, 0.46, 0.45 and 0.39 for 23, 20, 17 and 14, respectively). At 47d, scores were higher for 23 (1.16) and 20 (1.06) as compared to 17 (0.71) and 14 (0.60), and again L effects were linear. At 34d in E2 L affected gait score with longer daylengths resulting in higher values (0.67a, 0.34b, 0.19c, 0.18c). Skeletal defects resulting in culled birds or mortality were similarly affected by L regardless of time period or experiment. The mean values for 23, 20, 17 and 14 were 1.54, 1.29, 0.61 and 0.48% for E1 7-39d, 3.24, 2.54, 0.83 and 0.54% E1 7-49d (linear) and 1.70, 1.10, 0.42 and 1.00% for E2. In conclusion, increasing the hours of daylength resulted in reduced mobility in broilers, likely due to an increase in leg defects such as those noted in the mortality and morbidity data.

Key Words: broiler, photoperiod, mobility

206 Neurobiological basis of sensory perception: Welfare implications of beak trimming in poultry. W. J. Kuenzel*, *University of Arkansas, Fayetteville.*

The beak of birds is used for feeding, drinking, pecking, grasping, preening and other necessary functions. It is also utilized in aggressive and defensive activity that can result in injury and cannibalism. Consequently a practice in the industry, particularly in breeding stock, is to beak trim poultry in order to minimize the effects of aggressive

behavior. The beak encases the buccal cavity that contains the tongue, taste buds, salivary glands, blood vessels, nerves, receptors and other components. Beak trimming can impact the appropriate function of the bill and buccal cavity including mandibulation, sensing and discriminating among sizes and tastes of food items, producing adequate amounts of saliva in the mouth and esophagus, and maintaining the plumage of the body. The beak is a major component of the somatosensory and somatomotor system comparable to the same neural system that has been well understood in humans and other mammalian species. Therefore an emphasis will be placed upon a comparison of the neural pathways that have been mapped from the mandibular (mouth and jaw) region of mammals and poultry. Coverage of nociceptors, mechanoreceptors and thermoreceptors that reside in the beak and buccal cavity, afferent nerves of the fifth and seventh cranial nerves that serve the upper and lower mandibles, tongue and face region will be noted. The pathways where sensory information from the mouth is delivered to the brain, specifically to the principal trigeminal sensory nucleus in the brainstem will be shown followed by the three distinct forebrain areas that process sensory input from the beak. In addition, neural sites where information leaves the forebrain and is transmitted via efferent pathways to motor systems will be documented. The review will also include the methods used to beak trim poultry, extent of the bill recommended for trimming, age/s when trimming occurs and abnormalities, such as neuromas, that can occur particularly when excessive beak trimming is practiced. Finally key areas where further research needs to be undertaken will be outlined.

Key Words: trigeminal nerve, facial nerve, nociceptors

207 Relationship between body weight and beak characteristics in 1 d old layer chicks. A. G. Fahey^{*1,2}, R. M. Marchant-Forde², and H. W. Cheng¹, ¹Purdue University, West Lafayette, Indiana, ²USDA, West Lafayette, Indiana.

The aim of this work was to determine if any relationship exists between body weights and beak characteristics in day old chick with a view to developing an automated system for standardizing infrared trimming. Three hundred and forty four day old layer chicks were weighed and digital pictures were taken of their beaks. Beak sizes were enumerated using MCID Imaging Software. The width of the upper mandible was measured 2mm (W2mm), 3mm (W3mm), and 4mm (W4mm) from the tip of the beak. The lengths of the culmen, gonys, maxillary tomia (maxi), and the mandibular tomia (mand) were also measured. All parameters had non-normal distributions so non-parametric Spearman rank-order correlations were calculated between body weight and each beak dimension. The correlations are shown in Table 1 with P-values displayed in parentheses. Weak negative correlations were found for W2mm, W3mm, and W4mm, and weak positive correlations were present for culmen, gonys, maxi, and mand lengths. Significant P-values were also evident for W2mm, W3mm, culmen, gonys, and mand. However this may have been due to the relatively large sample size (n=344) as the actual correlations (r²) with body weight were really too low (all below 0.16) to be meaningful. In conclusion, the weight of a 1-day old chick is not a sufficient indicator of the size of its beak and as such should not be relied upon. Additional work is necessary to identify an accurate yet efficient way to separate chicks according to beak size to improve the accuracy of any subsequent beak trimming in terms of the relative amount of beak trimmed.

Table 1. Relationship between weight and beak characteristics

	W2mm	W3mm	W4mm	Culmen	Gonys	Maxi	Mand
BW	-0.14 (0.011)	-0.13 (0.015)	-0.09 (0.114)	0.15 (0.007)	0.16 (0.004)	0.10 (0.057)	0.15 (0.005)

208 Infrared beak treatment: Part I, Comparative effects of infrared and 1/3 hot-blade trimming on beak topography and growth. R. M. Marchant-Forde^{*} and H. W. Cheng, *USDA-ARS, West Lafayette, Indiana.*

This work is the first in a series of studies examining the effects of infrared treatment on production and well-being. Seventy-two layer chicks were assigned to hot-blade trimming (HB) (1/3 beak), infrared treatment (IR) at 60 W to cause in a 1/3-1/2 reduction in beak length, or a control (C) treatment at 1 d old. Chicks were pair housed by treatment and beak photos and production indices (feed intake, waste & body weight (BW) were obtained right after treatment and at +2 d, +4 d and then weekly until 9 wks later. Changes in beaks were evaluated using MCID Imaging Software. All beaks were considered normally shaped at the onset of the study and no perceptible differences in shape occurred over time (P>0.05). Different trimming methods did however result in: varying proportions of trimming across treatment (P<0.01); different beak lengths over time (P<0.01) and; changes in upper to lower mandible length ratio (P<0.01). Just after treatment, HB birds had shorter beaks relative to the other two groups (P<0.05). C and IR beaks remained analogous until the onset of tissue degeneration and erosion in the IR beaks 2 d to 2 wks after treatment. Thereafter, there was an increase in length in all treatments over time (P<0.01). Two weeks post treatment, beaks were longest in C, intermediate in HB (30% shorter than C, P<0.001) and shorter in IR birds (50% shorter than C, P<0.001). Finally, HB birds exhibited more deviations from a normal upper:lower mandible length ratio (P<0.05). Notable effects of treatment on production emerged by +2 d and persisted for 5 wks afterwards. Growth and feed intake were suppressed in HB & IR birds compared to C birds (P<0.05) with IR birds performing least well until the 4th wk of the study (P<0.05). Thereafter they performed numerically, though not statistically, better than the HB group. Feed waste was always lowest in the IR groups but alternated in the other two groups over time (P<0.05). The negative effects of trimming appeared greatest in the IR birds initially but these differences dissipated over time. Further work reports on the effects of IR treatment on morphology, behavior and other well-being indices.

209 Infrared beak treatment: Part II, Comparative effects of infrared and 1/3 hot-blade trimming on behavior and feeding ability. R. M. Marchant-Forde^{*} and H. W. Cheng, *USDA, West Lafayette, Indiana.*

The goal of this research was to examine the impact of infrared treatment at 1 d of age on behavior and feeding ability compared to hot-blade trimming. Seventy-two layer chicks were assigned to hot-blade trimming (HB) (1/3 beak), infrared treatment (IR) at 60 W (1/3-1/2 reduction in length), or a control (C) group at 1 d old. Chicks were pair housed by treatment and behavior was recorded on day 0-4 and weekly thereafter. A feeding test was used to determine treatment differences in feeding ability by assessing both feeding behavior and feeding rate (intake/peck). There was largely an effect of treatment

on the behavior post treatment ($P<0.05$). Specifically, C birds spent less time standing resting ($P<0.01$) and more time eating ($P<0.01$) and drinking ($P<0.05$) than IR birds. Furthermore, the number of pecks delivered at the drinker during imbibing was also suppressed by IR treatment ($P<0.01$). Aside from a tendency for HB to have shorter eating bouts than C ($P=0.09$), all other feeding indices in HB scored intermediary to those in C and IR with no perceptible differences. Treatment effects were most prominent in the initial 24-48 h post treatment with decreasing incidences of differences over time ($P<0.05$). During the feeding test, C birds took less time to approach the feeder and initiate feeding and had higher intake and feed wastage scores than HB or C during the first 3 wks after trimming ($P<0.05$). HB generally scored intermediary in these indices but there were few differences between HB and IR. C birds were the most efficient feeders ($P<0.05$) but there were no differences in among HB or IR ($P>0.05$). Both H & IR birds performed more head flicking than C ($P<0.05$) and HB birds also exhibited more bill wiping and wing flapping during the test ($P<0.05$). General behavior highlights an initial decrease in activity in IR birds that may indicate greater discomfort immediately post trimming. However, most other indices of behavior and feeding ability indicate few differences HB and IR in spite of more severe trimming in the IR birds. Further work reports on the comparative effects of HB and IR trimming 1/2 of beaks.

210 Infrared beak treatment: Part III, Comparative effects of infrared and 1/2 hot-blade trimming on beak topography and growth. H. W. Cheng* and R. M. Marchant-Forde, *USDA, West Lafayette, Indiana.*

The aim of this work was to compare the effects of infrared treatment (IR) and hot-blade trimming (HB) at 1 day of age on beak length and

production. As previously, 72 layer chicks were assigned to HB (1/2 beak), IR at 60 W (1/3-1/2 reduction in length), or a control (C) group at 1 d old. Chicks were pair housed by treatment and beak photos and production indices were obtained after treatment and at +1 d, +5 d and then weekly until 10wks later. Changes in beaks were evaluated using MCID Imaging Software. Immediately after trimming HB beaks were between 40-45 % shorter than C or IR ($P<0.001$) and remained shorter than C beaks for the duration of the study ($P<0.01$). There were no differences in C and IR beaks until the onset of tissue degeneration in IR that occurred during the 2nd and 3rd wks post trimming ($P<0.05$). IR beaks were similar to HB beaks until wks 9 & 10 when a faster growth rate resulted in longer beaks in HB ($P<0.01$). IR beaks were shorter than C beaks from the time of tissue degeneration to the end of the study ($P<0.01$). By 10 wks, HB beaks were about 20% shorter, and IR beaks were 50% shorter, than C ($P<0.01$). The effects of treatment on BW emerged 5 d after trimming when IR and HB weighed 7% ($P<0.05$) and 17% ($P<0.001$) less than C ($P<0.05$). BW in HB was suppressed up to, and including, 9 wks post trimming relative to C birds ($P<0.05$), and was significantly lower than in the IR group between 2-4 wks ($P<0.05$). IR birds did not differ from C birds after wk 3 and by the final week of the study there were no longer any apparent differences in BW in any treatment. For the most part, FI was higher in C, intermediary in IR and lowest in HB birds until wk 9 post treatment ($P<0.05$). Similarly, waste was generally higher in C birds and least in the HB group ($P<0.05$). It appears that 1/2 HB trimming had a more pronounced impact on production and growth than IR trimming. Effects on beak length were similar until HB birds exhibited an increase in beak growth rate towards the end of the study. Furthermore, HB trimming seems to inhibit FI and BW to a greater extent than IR treatment with no perceptible benefits in beak length at 10 wks of age.