Production, Management and the Environment: General

1012   A mobile modified atmosphere killing unit for small flock depopulation.   A. B. Webster* and S. R. Collett, *University of Georgia, Athens*.

In addition to having methods for depopulation of commercial poultry flocks to contain outbreaks of serious avian disease, there is need to have an efficient and humane method to dispose of small flocks that might fall within an affected area. A modified atmosphere killing (MAK) chamber mounted on a trailer to be pulled by a pickup truck was designed for small flock depopulation. The atmosphere inside the chamber is controlled automatically using gas sensors. A portable gasoline generator drives the electronic systems so no external electrical supply is required. The chamber (152.5 cm W × 152.5 cm L) has a total interior volume of about 2.1 m^3, with a 1 m^3 section to hold birds below gas injection nozzles distributed 44.5 cm above the floor around the perimeter of the chamber. The chamber rises to a height of 51 cm to provide sufficient head space to load birds through 4 doors, 2 on each side of the chamber. The loading doors can be sealed shut and the trailer sanitized by a disinfectant solution pumped from a self-contained 114 L tank before the trailer leaves the premises to deliver a killed flock to a disposal site. A hydraulic lift facilitates dumping of carcasses. The MAK trailer was tested in several trials using spent layer breeder hens, spent laying hens, and turkey hen broilers. CO_2 levels during loading were targeted at 45–50%. The highest rate of loading was 2.8–3.4 s per bird during trials with the spent layer breeders. Since the floor capacity of the chamber is about 100 birds, this rate of loading is unlikely to cause birds to be overlain by others before onset of unconsciousness. Chamber temperature and RH during turkey trials ranged from 24 to 29 C and RH from 55 to 85%. Maximum loads ranged from 305 to 440 hens (total wt. 567–609 kg), and 79 turkeys, (555–560 kg). In its final configuration, the MAK unit was able to maintain effective stunning/killing atmospheres during use. Loading could be continuous when CO_2 was used but N_2 required birds to be killed a layer at a time to prevent piling of conscious birds.

Key Words: depopulation, poultry, small flock

1013   Overview of lighting in Kentucky broiler houses.   D. G. Overhults[1], A. J. Pescatore[1], I. Lopes[1], G. Morello[1], J. P. Jacob*[1], J. Earnest, Jr.[1], M. Miller[2], and R. S. Gates[3], [1]*University of Kentucky, Lexington,* [2]*Kentucky Poultry Federation, Winchester,* [3]*University of Illinois, Champaign*.

Floor level illuminance was measured in the brood area of 37 broiler houses on 25 farms in 5 different production complexes in Kentucky. A light meter was used to measure light intensity under both "bright" and "dimmed" light conditions that were typically used during flock growout. Measurements were taken between light fixtures at each of the 4 water lines and at the center line of the house. All houses had lights installed above the 2 feed lines. Some houses had additional lights at the center line of the house. In general, lighting type and intensity was inconsistent from farm to farm. A variety of incandescent (IN), compact fluorescent (CFL), cold cathode (CC), and high pressure sodium (HPS) bulbs were used. Fixture spacings over the feed lines varied from 10 to 30 feet. Bulb sizes varied from 5 W CFL to 100 W IN. Two complexes used only CFL lights, usually with 2 alternating size bulbs in each light string. Dimming was accomplished by turning off the larger size bulbs. Various electronic dimmers were used to dim CC and IN bulbs. Under bright light conditions, average light intensity was 11.0 lx, but the range was large. Bright light intensities ranged from 3.2 to 49.5

lx, with the intensity on most farms being concentrated in the mid to lower part of that range. The highest intensity occurred in a house that was using oversized CFL bulbs. Dim light intensities were all less than 6 lx with most farms operating at less than 3 lx. Where IN lights were used, energy cost savings for converting to CC or CFL systems were estimated. Depending on the farm, changing existing IN bulbs to CC or CFL bulbs may save 8,000 - 12,000 kWh/house/year. The payback period for conversion is affected by number of light fixtures, size of bulbs, lighting program, dimming system, range of illuminance, and electric power rates. Various estimates of payback periods generally fell in the range of 6 mo to 2 years. Estimates of payback periods did not include installing any additional fixtures that might be needed to maintain or increase the existing light intensity levels.

Key Words: light intensity, broilers, energy

1014   Evaluation of the effect of supplementing complex trace minerals on the development of claw lesions in stall-housed sows.   S. S. Anil*[1], L. Anil[2], J. Deen[1], S. K. Baidoo[2], M. E. Wilson[3], and T. L. Ward[3], [1]*Veterinary Population Medicine, University of Minnesota, St Paul,* [2]*Southern Research and Outreach Center, University of Minnesota, Waseca,* [3]*Zinpro Corporation, Eden Prairie, MN*.

Claw lesions are very common in pigs and are reported to be associated with lameness. Trace minerals such as Cu, Zn and Mn are critical in the keratinization process and thus may affect the generation and development of lesions. Both the quantity and form (organic or inorganic) determine the bioavailability of the trace minerals. The objective of the present study involving 129 sows (mixed parities) was to evaluate the effect of supplementing complex trace minerals on the development of lesions in different claw areas (side wall, heel, sole, heel-sole junction, white line and overgrown dew claw and toe) of stall-housed gestating sows. The sows were allocated randomly to 2 groups and fed either a control diet (inorganic sulfate minerals, ITM; n = 66; Zn 125 ppm, Mn, 40 ppm and Cu, 15 ppm) or a diet containing complex trace minerals (CTM; n = 63) as a partial substitution of inorganic minerals (Zn, 50 ppm, Mn, 20 ppm and Cu at 10 ppm) fed at isolevels of total trace mineral supplementation. The lesions in different claw areas of these sows were scored by a trained person in 2 consecutive parities at mid-gestation, using a mechanical chute designed for the purpose. The total score for each claw area was obtained by adding the scores for that area in different claws. The proportions of sows showing either similar scores or lower scores in the second claw lesion examination in the sows fed CTM or ITM were compared using 2-sample proportion test (SAS v. 9.1). A higher ($P < 0.05$) proportion of sows fed CTM (95 vs. 82%) had a decrease in the severity or no change in severity of heel-sole junction lesion score. The proportions of sows with similar or lower scores for total lateral claw lesions, long toes, heel lesions, white line lesions and vertical side wall lesions were higher in the sows fed CTM, though not statistically significant ($P > 0.05$). These data suggest a protective effect of complex trace minerals on claw lesions in stall-housed sows.

Key Words: claw lesions, stall housing system, trace minerals

1015   Correlation between production traits and sexual behavior in white-faced yearling rams.   V. A. Uthlaut*, G. E. Moss, R. H. Stobart, B. A. Larson, and B. M. Alexander, *University of Wyoming, Laramie*.

Of the 196,000 rams in the US, approximately 23% are expected to be non-performers. This results in an annual loss of $13.5 million to

US sheep producers. The objective of this study was to determine the discriminating value of production traits so that measures of production may be used as indicators of reproductive performance. White faced rams consigned to the Wyoming ram test in 2008 (n = 33) and 2009 (n = 41) were tested for expression of sexual behavior while being evaluated for production performance. At the time of behavior testing, rams were 10 mo to 1 yr of age. In 2009, rams were fed using the Grow-Safe feeding system and feeding behavior was correlated to sexual behavior. Sexual performance was evaluated by exposing individual rams to 2 ewes in estrus for 30 min for a maximum of 3 times. Sexual behavior was categorized as: anticipatory (ano-genital sniffs, Flehmen response, fore-leg kicks and nudges) and consummatory (mount attempts, mounts and ejaculations) behavior. Rams exhibiting consummatory behavior were not re-tested. Rams were classified low (LP; n = 18), intermediate (IP; n = 23) or mounting (M; n = 33) according to the level of sexual behaviors exhibited. Rams classified as LP and IP exhibited total anticipatory behaviors ≤ 9 (mean = 4.8 ± 2.7) or ≥ 10 (mean = 23.7 ± 10.7), respectively, but did not exhibit mounting behavior. M rams mounted a ewe at least once (anticipatory mean = 43.5 ± 24.7; consummatory mean = 9.5 ± 7.0). For production traits, each ram was assigned an index ratio based on body weight gain and adjusted for wool characteristics. Data were analyzed using GLM and CORR procedures of SAS. Sexual behavior classification did not influence ($P \geq 0.5$) index ratio, feed consumed per day, or number of feed intake episodes. Although anticipatory and consummatory behaviors (r = 0.48; $P < 0.05$) and test index ratio and feed consumption (r = 0.50; $P < 0.05$) were highly correlated, sexual behaviors were not significantly correlated with the index ratio (r = 0.08; $P = 0.5$). Measures of production performance do not appear to be reliable predictors of sexual behavior in yearling rams.

1016   Optimal livestock gross margin for dairy insurance contract design.   M. Valvekar, V. E. Cabrera*, and B. W. Gould, *University of Wisconsin, Madison.*

Volatility in milk and feed prices are a major source of dairy farm risk. Since August 2008 a new federally reinsured insurance program referred to as Livestock Gross Margin Insurance for Dairy Cattle (LGM-Dairy) has been available to many US dairy farmers to help manage the variability in dairy income over feed costs. In the design of the desired insurance contract, the dairy farmer has to decide on the percentage of monthly milk production to be covered by this insurance contract. The objective of this paper was to develop an algorithm and a user friendly software system to identify the optimal LGM-Dairy contract for a risk neutral dairy farmer in terms of monthly coverage at the lowest premium such that a target guaranteed income over feed cost (TGIOFC) is obtained. We optimize our nonlinear programming model via the use of a generalized reduced gradient method. The premium solver platform, V5.0 (Frontline systems, Incline Village, Nevada) within the Excel software system was used for optimization. The analysis was done for a representative 120 herd size dairy farm producing 8,873 kg milk per cow per yr. Wisconsin statistical data indicated that similar sized dairy farms require an income over feed cost (IOFC) of at least $110 per Mg milk to be profitable during the coverage period. Using these data for the July 2009 insurance contract to ensure $110 per Mg milk, the least premium cost contract was found to have a premium of $1.22 per Mg milk produced insuring approximately 52% of the annual production with variable monthly production covered over the September 2009 to June 2010 period. This premium represented 1.10% of the desired TGIOFC. An alternative non-optimal strategy, defined as a contract insuring the same proportion of milk as the optimal (52%), but with constant percentage coverage each month of the insurance contract

was analyzed. The premium for non-optimal strategy was found to be almost twice the level obtained under the optimal solution representing 1.9% of TGIOFC.

Key Words: risk management, price risk, revenue insurance

1017   Do hyphenated techniques permit the speciation of metal glycinate complexes?   C. Ionescu*[1], V. Vacchina[2], R. Lobinski[3], S. Oguey[1], and D. Bravo[1], [1]*Pancosma, Geneva, Switzerland*, [2]*UT2A, Pau, France*, [3]*CNRS, Pau, France.*

Trace elements inclusion as feed additives is based on their metal content. This is mainly due to the unavailability of analytical methods differentiating trace element sources. The objective was to develop a method allowing specific determination of Zn, Cu, Mn and Fe glycinate complexes (BT) from sulfate (SU), citrate (CI) or histidinate (HI), preserving BT molecular integrity. A mixture of the 4 BT standards was used to optimize the analytical conditions. Five couplings were tested: size exclusion liquid chromatography with coupled to inductively coupled plasma spectrometry (SE HPLC-ICP-MS); hydrophilic interaction liquid chromatography (HILIC) with ICP-MS; Zwiterionic (ZIC)-HILIC with ICP-MS and capillary electrophoresis (CE) coupled either with electrospray mass spectrometry (ESI MS/MS) or ICP-MS. The SE HLPC-ICP-MS, HILIC-ICP-MS or ZIC-HILIC-ICP-MS coupling did not permit separation of BT from SU. Coupling of CE with ICP-MS gave the best results. All BT electropherograms contained a single peak. The 4 BT injected simultaneously were separated suggesting an efficient electrophoretic separation. The ICP-MS signal specificity was proven comparing experimental vs. theoretic trace elements isotopic ratios and peak absence in the blank. BT Cu was well separated from SU, CI and HI. BT Zn was well separated from SU and HI but not from CI. BT Mn was well separated from SU but there was an overlapping with CI and HI. BT Fe was well separated from SU or CI but not from HI. However, CI and HI were reconstructed complexes and not standards. BT molecular integrity was checked using CE ESI-MS(/MS) coupling. BT polymers were destroyed explaining the single peak in CE-ICP-MS electropherograms. BT sulfate ligand was lost but metal-glycine link was preserved. These results make capillary electrophoresis a promising tool for the quantification of BT. Providing validation of the method, the coupling CE-ICP-MS may allow the quantitative speciation of BT in feedstuffs.

Key Words: traceability, glycine complex, chelate

1018   Determination of metal glycinate in premixes using capillary electrophoresis coupled with an inductively coupled plasma mass spectrometry detector (CE-ICP-MS).   C. Ionescu*[1], V. Vacchina[2], S. Oguey[2], R. Lobinski[3], and D. Bravo[1], [1]*Pancosma, Geneva, Switzerland*, [2]*UT2A, Pau, France*, [3]*CNRS, Pau, France.*

Previous results have shown that capillary electrophoresis coupled to inductively coupled plasma mass spectrometry (CE-ICP-MS) was a promising tool for metal glycinate (BT) speciation. The objective was to validate this method and to use it to determine BT concentration in mixes. The analytical conditions developed included an electrolyte made of 20 mM ammonium acetate (pH 7.4), a voltage of 30 kV and a hydrodynamic injection of 1 s. Specificity of the method was previously discussed. The analytical figures of merit of the approach were then determined. The calibration curve, made of 6 points, was linear ($R^2 > 0.995$). The repeatability (n = 10 for concentrations in the middle range of the calibration curve) was below 12%. In the absence of Certified Reference Material, accuracy was evaluated by analyzing quality control samples in the lower, medium and upper range of the calibration curve

(n = 3). It was generally below 15%. Detection limits, calculated as 3 times the STD of the blank plus the blank, were between 0.05 and 0.2 µg metal.mL^{-1} depending on the BT due to the specific sensitivity of ICP MS. The coupling CE-ICP-MS was then used to quantify BT in four kinds of premixes based on either minerals (as sulfates), choline chloride, amino-acids or acid salts. The BT concentrations in premix were set as follows: BT Zn 8.9 mg/g, BT Cu 6.4 mg/g and BT Mn 18.7 mg/g. The electropherograms of the 4 premixes containing Cu, Zn and Mn BT were made of one peak absent from the corresponding control premix and matching the migration time of a BT standard. Concentrations in the premixes ranged from 8.8 - 9.1 mg/g for BT Zn, 6.3 - 6.6 mg/g for BT Cu and from 18.4 - 18.9 mg/g for BT Mn. These results show that BT can be analyzed and quantified in premixes, giving some new opportunities to the feed producers to introduce BT with precision in their diets and progress on the effective dose of these products.

Key Words: traceability, glycinate complexes, chelates

1019   Determining the optimal age for recording the retinal vascular pattern image of lambs.   M. A. Rojas-Olivares[1], G. Caja*[1], S. Carné[1], A. A. K. Salama[1], N. Adell[2], and P. Puig[1], [1]*Universitat Autònoma de Barcelona*, *Bellaterra, Barcelona, Spain*, [2]*Universitat de Girona*, *Girona, Spain*.

A total of 143 newborn lambs of Ripollesa breed were used for assessing the optimal age at which the vascular pattern of the retina can be used as reference for identification and traceability. Retinal images (RI) from both eyes were recorded in duplicate using an OptiReader camera (Optibrand, Fort Collins, CO) at d 1, 8, 30, 90, 180 and 360 of age. Digital images (n = 2,544) were treated with the Optibrand Data Management Software (v. 4.1.3) and intra- and inter-age comparisons of pairs of RI were made using Optibrand's matching score (MS). A MS <70 was used as exclusion criterion (0.989 sensitivity, probability of a correct match; and, 0.995 specificity, probability of a correct non-match). Three Spanish commercial categories of harvesting lambs were used for evaluating RI as a tool for tracing live lambs: "lechal" milk-fed lambs (1-mo, 12 kg BW), "recental" fattened light lambs (3-mo, 25 kg BW) and "ovino mayor" fattened heavy lambs (6-mo, 35 kg BW). Values of MS did not show normal distribution as raw data or after different transformations, and were treated with a model based on the one-inflated bivariate β distribution by using the R computing software (www.r-project.org). Using likelihood ratio test to compare data, intra-age RI analysis showed that MS increased from d 1 to 180 (81 to 96, respectively). Percentage of RI with MS >70 increased from d 1 to 90 (76 to 100%) and steadied thereafter. No images before d 30 were satisfactory to be used as a reference. Inter-age RI for 1-mo "lechal" lambs showed that the 8-d RI tended to show a better traceability than those taken at 1-d of age (91.4 vs. 83.7%, respectively; *P* = 0.070). For 3-mo "recental" lambs, RI taken at 30-d of age traced better than RI taken at 8-d of age (99.2 vs. 89.8%, respectively; *P* < 0.05). Finally, for "ovino mayor" 6-mo lambs, the RI taken at 90-d of age showed the best traceability (99.2%) which was higher than those taken at 8-d (81.4%; *P* < 0.05), but did not differ from those taken at 30-d of age (94.8%; *P* > 0.05). In conclusion, retinal imaging was an accurate tool for auditing the identity and traceability of live lambs of different commercial categories.

Key Words: retinal image, identification, traceability

1020   Predicting probability of pregnancy using all activity signals prior to pregnancy diagnosis.   A. H. Sanders*, A. De Vries, and J. Block, *University of Florida*, *Gainesville*.

Increased physical activity can signal estrus in dairy cattle. Activity in the milking interval before AI can indicate an improved probability of pregnancy. This study considered the addition of activity data collected between AI and pregnancy to the prediction of pregnancy probability. Data were 632 breeding records from the University of Florida research herd, and activity recorded at twice daily milkings as avg. steps/hr since last milking by S.A.E. Afikim pedometers. The percent deviation of each activity record from the previous 10d rolling average of the same (a.m. or p.m.) milking session was calculated. Using a threshold of 84.2%, deviations were re-coded as binary signals of increased activity. All inseminations were timed AI (TAI) following Ovsynch. All were in late morning by one inseminator. At 32d after TAI, pregnancy (P32) was determined by ultrasound. Overall, 45% of cows were pregnant. Logistic regression was used to evaluate the effect of 4 signal profiles on probability for P32. Signal profiles were no signal (NONE, n = 228), signal only on morning of AI (TAI, n = 98); no signal on morning of AI, but at least one signal before pregnancy diagnosis (POSTAI, n = 234); and signal on morning of TAI, and at least one other signal before pregnancy diagnosis (BOTH, n = 70). The lowest P32 was for POSTAI (18.4%; CI = 13.9–23.9), and the highest (80.6%; CI = 71.6–87.3) was for TAI. An additional later signal (BOTH) significantly reduced P32 compared with TAI (OR = 0.05.). A signal after AI (POSTAI+BOTH) significantly reduced P32 compared with cases with no later signal (NONE+TAI) irrespective of signal before TAI (OR = 0.13). First post-AI signals averaged 17d after TAI, with median = 19d and mode = 21d. Activity signals can provide information about probability of pregnancy before pregnancy diagnosis by ultrasound or palpation. Further study is needed to determine the potential value of this information, if used to initiate early intervention in cows predicted to be not pregnant.

Key Words: activity, pregnancy, pedometer

1021   Development of a model for heat stress response in primiparous sows during critical stages of reproduction.   E. A. Coate*, M. C. Lucy, P. A. Eichen, and D. E. Spiers, *University of Missouri-Columbia*, *Columbia*.

Heat stress has detrimental effects on physiological status of sows that is compounded near farrowing and during lactation. A study was designed to identify superior determinants of heat response that encompasses these periods. Setup included primiparous sows (n = 15) housed in the Brody Environmental Center (University of Missouri) beginning the last 3 weeks of gestation through post-weaning period. Specific analysis periods were:1) several days before parturition, 2 and 3) 2 periods during mid-lactation, and 3) early postweaning. All animals were exposed to the same daily ambient temperature (Ta) cycle of 23.8–30.9°C. Daily measurements at 0800, 1200, 1600 and 2000 included rectal temperature (Tre) and respiration rate (RR). Skin temperature was recorded for ear, tail, rump, and shoulder sites using infrared thermography (Raytek, Santa Cruz, CA). Third order polynomial regression models were used to examine curvilinear Tre and RR relationships to Ta and skin temperatures across all periods. The range of correlation between Tre and RR to Ta was extremely low and not always significant (*P* < 0.05) at 0.03–0.14 and 0.09–0.31, respectively. In contrast, the combined relationship ranges for rump and shoulder temperatures were 0.15–0.42 (Tre) and 0.19–0.36 (RR). Although nearly all skin temperature relationships were significant at *P* < 0.05, there was a reduction in values from Periods 1 and 2 to Periods 3 and 4. Curvilinear relationships of Tre to skin temperatures exhibited a shift from Period 1 (preparturition) to Periods 2, 3, and 4, as characterized by a more than a 1°C shift in both skin and rectal temperatures. Similar comparisons for RR showed again the 1°C increase in skin temperature relative to RR. However,

there was no reliable shift in RR across periods. Skin temperature is possibly superior to ambient temperature in predicting thermal status because the pig utilizes shifts in its microenvironment (i.e., lying on the floor vs standing) without changing its general environment.

Key Words: pig, reproduction, heat stress