

management to industry, becoming more involved with applied research, demonstration and technology transfer on feed management, and looking for ways to provide incentives, both monetary and non-monetary, for the adoption of feed management practices.

Key Words: Feed Management, Environment, Industry Nutritionists

644 Development of rapid methods for assessing nutrient bioavailability. S. C. Ricke*, V. I. Chalova, and W. K. Kim, *Texas A&M University*.

Accurate assessment of nutrient bioavailability is critical for achieving an optimal balance between sufficient and excess for major feed components such as protein sources. Optimizing feed protein sources for farm animal amino acid (AA) requirements is difficult to achieve given the variations in protein quality. Feeding excess protein to meet AA requirements contributes to excess nitrogen (N) environmental pollution. To avoid productivity losses from an improper AA balance, feeds can be supplemented with pure AA to reduce animal N excretion. This requires AA bioavailability assessment by animal bioassays prior to supplementation. However in addition to the time commitment and costs,

activism interests are beginning to restrict routine animal tests. Ideally the animal feed industry needs alternative rapid methods for quantifying AA availability during feed processing. Rapid assays would allow animal nutritionists to adjust AA addition after assessing basal diet AA bioavailability. *In vitro* microbial bioassays for AA and other nutrients have been examined as a rapid alternative for a number of years. Such assays have the advantages of biological similarity to animal responses while retaining the flexibility and reproducibility capabilities of a conventional chemical test. Although several microorganisms have been examined, *Escherichia coli* has become the assay organism of choice because it is well studied, has simple growth requirements, and genetic modification is relatively easy. Given the molecular techniques currently available *E. coli* can easily be genetically engineered to provide an array of rapid whole cell AA biosensors. General application of this technology opens the door for more precise formulation at the feed mill and avoidance of unnecessary supplementation that result in animal production generated environmental problems.

Key Words: Nutrient Availability, Environmental Excess, Whole Cell Biosensors

Bioethics

645 Culture, values and ethics of animal scientists. John Hodges*, *European Association of Animal Production*.

Culture is defined as the shared worldview of a sub-set of humanity: race, nation, or professional group. In practice Culture means The way we do things around here. Values are the objectives that matter most to a person or to a cultural group to which priority of interest is consistently given in decisions allocating time, energy, resources, wealth and education. Ethics defines the moral component of each decision reflecting self-interest and/or concern about the well-being of other individuals or groups in society. Thus, in any sub-set of humanity, including professional animal scientists, Culture, Values and Ethics are closely linked. The normative cultural assumptions and commonly-held values of animal scientists guide group and individual decisions on the research and application of scientific knowledge. Strong links between animal scientists and business interests mean that the culture and values of commerce also inform and steer decisions by animal scientists. The food chain is increasingly watched by society as a whole, by governments and by special interest groups to determine the extent to which our behaviour is ethical or serving only our special interest group. The changing culture and values of societies in Europe and North America and Developing Countries are examined and compared with those of animal scientists. It is proposed that more radical changes in the culture and values of animal scientists are needed to match the assumptions of all societies for their food supply.

Key Words: Culture, Values, Ethics

646 An Argument that Animal Quality of Life Must be Central to Any Moral Justification of Animal Agriculture. W. R. Stricklin*, *University of Maryland*.

Personal experience has led to my belief that the majority of professional animal scientists have not seriously considered how they would

construct a full moral justification for animal agriculture. And current graduate programs in animal science commonly do not specifically challenge students regarding the moral basis of animal agriculture - or the implications of the student's research to this question. It is common for animal scientists to generally defend animal agriculture from a basis inclusive of premises such as 1) there is hunger in the world today, 2) the world population is expected to double in the next 30-50 years meaning more food must be produced, 3) animals utilize food stuffs not suited to human consumption, etc. However, rarely do animal scientists contend that food animals do - or can - benefit from their existence as sentient beings, i.e., having lived and experienced a reasonable quality of life. Singer originally argued in *Animal Liberation* that it is acceptable to produce food from animals provided they experience a quality of life comparable to that of a wild counterpart, but he subsequently argued that this is not possible with today's modern production systems. There is considerable agreement among the survey data on public attitudes indicating no trend toward vegetarianism or desire to move in that direction. However, there is very strong evidence in these same data sets indicating that the public seeks assurance that animals experience a reasonable quality of life. A utilitarian, or costs and benefits, moral argument for animal agriculture is strongest, possibly only defensible, when the quality of animal life can be predominantly placed into the benefits category - not included as a cost as many persons contend today. Incorporating consideration of the quality of the life experienced by animals into animal science teaching and research activities is in the best long-term interests of animal agriculture. It is also the right thing to do which further promotes the interests of all parties involved.

Key Words: Bioethics, Animal Sentience, Animal Science

Breeding and Genetics

647 Evaluation of Dorset, Finnsheep, Romanov, Texel, and Montadale breeds of sheep: Reproduction of F₁ ewes in spring mating seasons. K. A. Leymaster*, E. Casas, and B. A. Freking, *USDA-ARS, U.S. Meat Animal Research Center, Clay Center, NE*.

Objectives were to estimate effects of sire breed (Dorset, Finnsheep, Romanov, Texel, and Montadale), dam breed (Composite III and north-western whiteface), mating season (March and May), ewe age (4, 5, and 6 yr) and their interactions on reproductive traits of F₁ ewes. A total of 1,099 F₁ ewes produced 1,754 litters from 2,330 exposures to Suffolk rams during 42-d mating seasons. Litter size and weight at birth were recorded and litter size and weight at weaning and 20 wk of age were analyzed separately for dam- and nursery-reared lambs. Total produc-

tivity from 4 to 6 yr of age for each ewe entering the breeding flock was calculated as the sum of 20-wk weights for dam-reared lambs. Interactions of sire breed x mating season, ewe age x mating season, and ewe age x dam breed were often significant. Interaction of sire breed x dam breed on conception rate ($P < 0.01$) was due to change in rank as well as magnitude. Averaged over mating seasons, Romanov x Composite III ewes had the greatest conception rate (93%) and Montadale x Composite III the lowest (64%). Interactive effects of sire breed and mating season on conception rate ($P < 0.001$) were due to differences in magnitude, with Romanov-sired ewes being most consistent between seasons (92% in March and 89% in May). Sire breed affected litter size at all ages ($P < 0.001$), ranging from 1.40 lambs at birth for Texel to 2.09 for Romanov. Differences between dam breeds in total productivity of dam-reared lambs were not detected, whereas ewes exposed in March (78

kg) were more productive ($P < 0.01$) than May (68 kg). Means of sire breeds for total productivity were 47, 65, 70, 70, and 111 kg for Texel, Montadale, Dorset, Finnsheep, and Romanov, respectively ($P < 0.001$). Superior reproduction of Romanov-sired ewes was due to greater conception rate and prolificacy at each mating season and ewe age. Use of Romanov crossbred ewes would increase fertility during spring mating, an important constraint of the sheep industry.

Key Words: Breeds, Reproduction, Sheep

648 Linear versus threshold model analysis of trainability in a colony of German Shepherd dog guides. J. Cole*¹ and E. Leighton², ¹*Animal Improvement Programs Laboratory, Agricultural Research Service, USDA, Beltsville, MD,* ²*The Seeing Eye, Inc., Morristown, NJ.*

The objective of this study was to compare linear and threshold models for genetic evaluation of trainability in a colony of dog guides. Data consisted of trainability and pedigree information on 3305 German Shepherd dogs produced for use as potential guides by The Seeing Eye, Inc (TSE). Trainability is used to assess the ability of a dog to work as a guide, and is scored on a 9-point ordinal scale. Scores range from 1 (worst) to 9 (best) and are assigned by TSEs training staff. A linear model (LM) is currently used by TSE to produce estimated breeding values (EBVs) for use in a selection index. However, theory suggests that a threshold model is the more appropriate tool for this type of analysis. A threshold model (TM) was used to estimate variance components and EBVs which were compared to the LM results. MTDFREML was used to fit the LM and CBLUP90REML was used to fit the TM. The model used for both analyses included fixed contemporary group and random additive animal and residual error terms. Heritability of trainability was 0.14 ± 0.03 and 0.19 for LM and TM, respectively. The algorithm used in CBLUP90REML prevented estimation of SEs in the TM. The higher heritability under the TM is consistent with theory. Pearson's product-moment and Spearman's rank correlations of LM and TM EBVs were 99.2 and 99.3, respectively, indicating that the LM does a good job of predicting and ranking the TM EBVs correctly. Genetic trend was positive for both analyses, 0.24 and 0.20 units/generation for LM and TM, respectively. Of the 3305 animals in the dataset, 2130 spent at least one day in training and 1175 did not. The distribution of trainability scores differed between dogs that spent at least one day in training and those that did not ($P < 0.001$). Trainability EBVs were higher for trained versus untrained animals under both the LM ($P < 0.01$) and TM ($P < 0.01$). While a TM is preferred from a theoretical viewpoint, the current LM does a good job of predicting genetic merit. The TM is preferred for the estimation of variance components, and suggests that the LM has been underpredicting the true heritability of trainability.

Key Words: Genetic evaluation, Dog guides, Threshold model

649 Developing breeding objectives for Targhee sheep. R. C. Borg*¹, D. R. Notter¹, R. W. Kott², and L. A. Kuehn¹, ¹*Department of Animal and Poultry Sciences, Virginia Polytechnic Institute and State University, Blacksburg,* ²*Department of Animal and Range Sciences, Montana State University, Bozeman.*

Breeding objectives were developed for Targhee sheep at different levels of prolificacy and triplet survival. Economic weights (EW) were derived for estimated breeding values (BV) from National Sheep Improvement Program genetic evaluations for 120 d weaning weight (WW), maternal milk (MM), yearling weight (YW), fleece weight (FW), fiber diameter (FD), staple length (SL), and prolificacy (LC; lambs born/100 ewes lambing). A commercial flock was simulated, accounting for nonlinear relationships between performance and profit. Ewes were assumed mated to sires of specified BV and profit was derived from lifetime performance of lambs and replacement females from that lamb crop. Economic weights were determined as change in profit from use of sires with BV that were one additive standard deviation above the mean for each trait [1.98 kg for WW, 1.62 kg for MM, 2.90 kg for YW, 0.36 kg for FW, 0.98 microns for FD, 0.74 cm for SL, and 17.58 lambs/100 ewes for LC], while holding all other BV at breed average. Separate breeding objectives were derived for different costs of meeting increased nutrient needs (P = purchase hay, R = rent pasture, and S = scaling back flock size). Based on replicated simulations, relative EW did not vary with prolificacy or survival ($P > 0.15$) but were affected by feed costs ($P < 0.01$). Selection indexes were derived within and across simulated scenarios, and correlation (r) among indexes of > 0.90 indicated that an

index could be used across multiple scenarios. Indexes derived within feed cost scenarios (P , R , and S) were strongly intercorrelated ($r > 0.97$). Correlations among average indexes (0.97 for R and P ; 0.70 for R and S ; 0.85 for P and S) indicated that two indexes could be used depending on whether flock size was scaled back (S) or not (NS) ($r=0.78$). Indexes were $1.0 WW + 0.23 MM + 0.61 YW + 0.95 FW + 0.26 FD + 0.08 SL + 0.18 LC$ for S and $1.0 WW + 0.33 MM + 0.26 YW + 1.25 FW + 0.29 FD + 0.09 SL + 0.24 LC$ for NS . For a standardized selection differential of one, the expected change in mean index values was 12.55 and 7.40 per ewe per generation for S and NS , respectively.

Key Words: Sheep, Selection Index, Breeding Objective

650 Genetic and environmental factors affecting camel reproduction. S. Hermas*, *Faculty of Agriculture, Department of Animal Production, University of Al-fatah, Tripoli, Libya.*

This study was conducted to evaluate the effect of various factors on female reproductive performance measured by days from parturition to first breeding (DMFB), service period (SP), days open (DO), number of services per conception (NS), conception rate (CR), calving interval (CI), age at first service (AFS), age at successful service (AS), service period (HSP), conception rate (HCR), age at first calving (AFC), and gestation length (HGL). The data used were 380 reproduction records from daughters of 11 sires. Two models were used to analyze the data. Model 1 included as fixed effects month of calving, season, sex of calf, color, age, and service sire. Model 2 included month and year of first service, the rest of factors in model 1 excluding month of calving, and sire as a random effect. The results of analysis of variance indicated a significant effect ($P < 0.05$) of month of calving on DMFB, NS, and CR. Season had highly a significant effect ($P < 0.01$) on DMFB, CI, and significantly affected CR and GL. Age had a highly significant effect on NS and CR. Service sire had a significant effect only on GL. In camel heifers, month of first service had a significant effect on AFS, AS, AFC, HNS, and HGL ($P < 0.05$). Sire and service sire had a significant effect on AS, AFC, HNS, HCR, CI, and HGL. Heritability, genetic and phenotypic correlations were calculated by paternal half sib method. Heritability estimates were 0.38 ± 0.16 , 1.1 ± 0.18 , 0.40 ± 0.17 , 0.02 ± 0.14 , 0.44 ± 0.16 and 0.39 ± 0.17 for DMFB, SP, DO, NS, CR, and AFC respectively. The repeatability estimates were 0.01 ± 0.09 , 0.11 ± 0.08 , 0.15 ± 0.08 , 0.18 ± 0.09 , 0.17 ± 0.08 , and 0.017 ± 0.09 for DMFB, SP, DO, NS, CR, CI, respectively. The additive genetic variation was fairly high indicating possible improvement through selection. Repeatability estimates were low, indicating large temporary environmental effects. The genetic and phenotypic correlations were estimated between all traits. These estimates ranged from medium to very high positive and negative indicating pleiotropic action of genes and common environment between traits of camel reproduction.

Key Words: Genetics, Camel, Reproduction

651 Development of web-based cow-calf decision support software. B. W. Bringham*, D. J. Garrick, and R. M. Enns, *Colorado State University, Fort Collins.*

Sire selection is an important decision directly affecting ranch profitability. The need for decision-support software is increasing with the growing number of EPD available. The objective of this project was to develop web-based tools to evaluate production and economic outcomes from the use of alternative sires. A model simulates the age structure of a herd to predict performance, revenues and costs while accounting for non-genetic effects such as age of the dam. Users provide a minimum number of production inputs comprising herd size, pregnancy rate, replacement rate, mature cow size, calf survival, birth and weaning weights. These define an equilibrium age structure and provide realistic production outcomes for the base herd. Genetic variables that simultaneously influence model behavior are limited to those economically relevant traits that are closely aligned to available EPD. These include heifer pregnancy, calving ease, mature cow size, cow maintenance requirements, stayability, birth and weaning weights. These EPD are used to derive a new equilibrium age structure and corresponding performance levels following perturbation of the base situation. The total number of cows is then modified, accounting for any change in feed requirements, to provide annual feed consumption identical to the base herd. Outputs from the model allow a producer to compare current herd production and economic performances to those predicted if alternative sires had been used and the system allowed to re-equilibrate. Primary

differences in revenue come from changes to the number and weight of sale calves. Other contributions to variation in revenue are from values of cull cows, replacement costs and dystocia costs. Discounting procedures are not included. In contrast to other models, the software provides for sire selection by simulation rather than simply generat-

ing economic values for subsequent use. Accordingly, the model needs to directly incorporate heterosis effects from multibreed evaluation and corresponding EPD from sire summaries.

Key Words: Decision Support, Cow-Calf, Sire Selection

Goat Species: Products

652 Protein profile of goat milk in relation with udder health status and somatic cell counts. G. Pisoni¹, L. Basiricò², P. Moroni¹, U. Bernabucci^{*2}, and G. Savoini³, ¹Dipartimento di Patologia Animale, Igiene e Sanità Pubblica Veterinaria, Milano, Italy, ²Dipartimento di Produzioni Animali, Viterbo, Italy, ³Dipartimento di Scienze e Tecnologie Veterinarie per la Sicurezza Alimentare, Milano, Italy.

The prerequisite to produce hygienic milk and cheese is udder health and, therefore, intramammary infections are the most persistent and widely spread group of diseases of importance to milk hygiene in dairy goats. The effect of udder health on yield and quality of milk and, consequently, on cheese yield and quality has been established. Milk from mastitic udders exhibits greatly increased proteolytic activity. The activity of plasmin (PL), plasminogen (PG), and plasminogen activator (PA) and their correlation with goat milk quality parameters (casein, somatic cell counts (SCC), and udder health status) were investigated. Forty goats from two flocks were monitored and used to provide milk samples. Does were machine milked twice daily without teat post-dipping. 50 mL of milk was collected aseptically from each goat and kept at 4°C until bacteriological procedures. The SCC were determined for each milk sample by an automated fluorescent microscopic somatic cell counter. Activities of PL, PG, and PA in milk were determined with a colorimetric assay. 5 mL of each milk sample was centrifuged and skimmed milk was analyzed to determine protein profile by SDS-PAGE. Quantification of the electrophoretically separated proteins was done by densitometry. Milk samples were categorized on the basis of the presence or absence of pathogens (healthy or infected udder) and as low SCC (< 1,000 × 10⁶/mL), medium SCC (between 1,000 and 2,000 × 10⁶/mL), or high SCC (> 2,000 × 10⁶/mL). The health status of the udder modified only SCC and PA activity; both parameters were higher (P < 0.01) in infected udders. The increase in SCC was followed by increases (P < 0.001) in PL and PA activities and γ -1, γ -2 and proteose-peptone contents, and by decreases in PG activity and α -casein and β -casein contents. Results of the present study demonstrate that udder health is not the main factor responsible for the increase of proteolytic activity and alteration of protein profile of goat milk.

Key Words: Goat, Milk, Protein Fractions

653 Silymarin administration to periparturient dairy goats: effects on milk production and quality. D. Tedesco^{*1}, S. Galletti¹, S. Rossetti¹, J. Turini¹, and G. Varisco², ¹Department of Veterinary Sciences and Technologies for Food Safety, Milan, Italy, ²Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna, Brescia, Italy.

Silymarin, a standardized extract from seeds of *Silybum marianum* L. (Gaertn) (milk thistle), is used for the treatment of liver diseases. Silymarin administration to periparturient dairy cows resulted in a lower postpartum body condition score (BCS) loss and a higher and earlier milk peak. The aim of the present study was to determine the effects of silymarin treatment in the periparturient period on lactation performance of dairy goats. A total of 24 dairy goats in their second pregnancy were divided into two groups according to BCS, health condition, and previous milk production. From 5 days prior to the expected kidding date to 15 d postpartum, the treated goats received 10 mL/d of silymarin as a water suspension, administered as an oral drench. Individual milk production was recorded on 7, 14, 21, and 28 DIM. Milk samples were collected on the same days and analyzed for protein, fat, lactose, urea, and somatic cell count. The BCS was evaluated on d -7, 0, 14, 21, and 28 from kidding. Silymarin treatment significantly increased milk production. In all days considered, milk yield of treated animals was higher with respect to control animals (P < 0.05). These differences were on average from 0.61 to 0.92 kg/d for each animal. Milk quality parameters were not different between treated and untreated goats. BCS was not different between groups. We conclude that silymarin administration to periparturient dairy goats had a positive effect

on milk production without affecting milk quality, confirming our results obtained with dairy cows. Silymarin was kindly granted by Indena S.p.A.

Key Words: Silymarin, Dairy Goat, Peripartum

654 Effects of goat breed and stage of lactation on yield, sensory quality, and fatty acid concentration of soft cheese. S. S. Zeng^{*}, K. A. Soryal, B. A. Fekadu, K. Tesfai, and B. Bah, Langston University E (Kika) de la Garza American Institute for Goat Research, Langston University, Langston, OK.

In the United States, Nubian and Alpine goats are two major dairy breeds and most dairy goat herds have a seasonal lactation. In this study, the effects of goat milk obtained from two dairy farms with different breeds of goats at various stages of lactation on yield, composition, sensory scores, and fatty acids of soft cheese (Chevré) were evaluated. Results obtained from this study indicated that dairy goat breeds did not affect cheese composition, sensory scores, or fatty acid concentrations (P > 0.05) except oleic acid. However, milk from Nubian goats resulted in a much higher cheese yield (2.71 vs 1.69 kg/10 kg of milk), a lower oleic acid concentration, and a lower unsaturated fatty acid concentration than that from Alpine goats (P < 0.05). Soft cheese made from late lactation milk had higher fat, protein, and total solids concentrations and yields than mid-lactation milk (P < 0.05). While the sensory scores of Alpine goat milk cheese varied throughout lactation, those of Nubian goat milk cheese were virtually the same regardless of stage of lactation. In conclusion, if a dairy goat herd is raised to supply milk for cheesemaking, Nubian goats or a mixed herd with at least some Nubian goats will be advantageous to cheese makers for a higher premium for their higher cheese-yield milk. In addition, a year-round breeding program could help minimize variations in cheese composition, yield, and fatty acid concentration, resulting in a more consistent quality of cheese throughout lactation.

Key Words: Goat Milk, Cheese, Fatty Acids

655 Growth and carcass characteristics of castrated or intact male Boer X Spanish goats grazing Marshall annual ryegrass. C. Hopkins-Shoemaker^{*1}, S. Solaiman², C. Kerth¹, W. Jones¹, and D. Bransby¹, ¹Auburn University, Auburn, AL, ²Tuskegee University, Tuskegee, AL.

Castration of food animals is a common management practice that imposes unnecessary pain and stress, is an extra cost, and may reduce performance. This study was conducted to determine the effect of castration on growth and carcass characteristics of Boer x Spanish goat kids. Seven intact males and seven wether goats (BW 38.03 and 34.79 ± 0.35 kg, respectively) were continuously grazed on Marshall annual ryegrass (*Lolium multiflorum* Lam.) for 56 d. Body weights were recorded after 4 h withdrawals from feed and water, for two consecutive days, every 2 wk. After d 56 animals were harvested and hot carcass weight (HCW), cold carcass weight (CCW), dressing percent (DP), kidney and pelvic fat (KPF), longissimus muscle area (LMA), backfat (BF), and other carcass parameters were measured. Average daily gain over 56 d was greater (P < 0.05) for intact males than for wethers (139 and 66 g/d, respectively). Carcass selection grades were similar between treatment groups: no differences (P > 0.10) were observed in HCW, CCW, or DP between treatment groups. Wethers had higher (P < 0.05) KPF than intact males (0.51 and 0.23 kg, respectively); however, BF and LMA did not differ (P > 0.10) between treatment groups. These results indicate that castration of young market goats reduced growth and did not provide any distinct advantage in carcass characteristics.

Key Words: Goat, Castration, Carcass Characteristics