animals. Furthermore, multiple superovulation regimes will decrease the number of ova collected.

Key Words: Superovulation, Nutrition, Goat

500 Effect of breed and progesterone priming on pregnancy rates in anestrous meat goats in response to the buck effect. L. Nuti*, S. Woldesenbet, and G. Newton, *Prairie View A&M University, Prairie View, Tx 77446*.

Our goal was to test the effects of male introduction, with and without progesterone (P_4) priming on pregnancy rates in three breeds of meat goats. Female Boer (B, n=35), Spanish(S, n=46) and Myotonic (M, n=57) goats were selected during seasonal anestrus(May/June). Half of the does of each breed were vaginally implanted with a P_4) controlled internal drug release(CIDR-G) device on May 7. After 12 days each doe received 1 ml(5 mg)of prostaglandin F2-alpha(Lutalyse). After 14 days all does were sorted by breed into one acre breeding traps. A buck was then introduced for 30 days. Ultrasound examination 30 days after buck removal revealed differences in pregnancy rates occurred between breeds. None (0/46) of the S, 21% (12/57) of the M and 40.6%(13/35) of the B breed became pregnant overall for all groups combined. CIDR-G treatment had little effect on pregnancy rate in the B breed (6/18, 33% vs 7/17, 41%) but a marked effect on the M breed(11/25, 44% vs 1/32, 3%). P_4 profiles before male introduction (blood samples taken on day of CIDR-G implant, day 9 post implant and on days 3,5,7 15 and 20 after implant removal) indicated that 40%(14/35) of B, 24%(11/46) of S and 24%(14/57) of M goats had P_4 levels greater than 1.0ng/ml serum, which is indicative of luteal activity. However, few of those with P_4 greater than 1.0 ng/ml serum became pregnant (B=2/14, S=0/11, M=4/14). P_4 profiles in each breed after male introduction indicated that some does (B=7, S=1, M=9) exhibited typical estrous P_4 patterns but did not become pregnant which may be indicative of silent heats or sires which had low libido.

Key Words: Goats, Male effect, Anestrus

501 Ovarian response and fertility in postpubertal does and hair sheep ewes to an induced estrus using either MGA feeding or progesterone sponges. S. Wildeus*[1], J. R. Collins[1], and D. H. Keisler[2], [1]*Virginia State University, Petersburg, VA,* [2]*University of Missouri, Columbia, MO*.

There are few commercial products available for estrus synchronization in small ruminants in the U.S. Melengestrol actetate (MGA), used for estrus suppression in feedlot heifers, has potential as an extra-label use product to induce and synchronize estrus in sheep and goats. This experiment evaluated the use of dietary MGA (0.5 mg/head/day) and two types of vaginal sponges (500 mg progesterone, P4; and 50 mg methylhydroxy progesterone acetate, MPA) in 30 postpubertal does and ewes to induce and synchronize estrus in May. Species were equally allocated to treatment groups and either group-fed once daily a MGA/corn/soybean meal supplement at 1.5% BW (n=14), or fitted with P4 (n=8) or MPA (n=8) sponges for 8 d. All animals received ad lib chopped hay, and sponge-treated animals received a corn/soybean meal supplement. At the end of treatment, all animals were injected (im) with 2.5 ml of PG-600 (200 IU eCG/100 IU hCG) and placed with a fertile, libido-tested male of the appropriate species fitted with a marking harness. Estrus was observed at 4-h intervals for 96 h. The incidence and rate of ovulation was determined after 4 d via laparoscopy, and pregnancy and fetal numbers were determined via transrectal ultrasound after 28 d. Data were analyzed using GLM and chi-squares procedures of SAS. MGA and sponge protocols did not significantly differ in estrus response (50 and 80%, respectively) and time to estrus (57.7 and 52.1 h, respectively), but pregnancy rate (7 and 44%, respectively) and ovulation rate (0.4 and 1.5, respectively) were lower ($P<0.05$) in MGA-treated animals. There were no differences in response between sheep and goats, and no differences between the two sponge types. Results suggest that MGA feeding can be used to induce estrus, but that efficacy was lower than was observed for vaginal sponge treatments.

Key Words: Melengestrol Acetate, Goats, Hair Sheep

502 Effect of fat supplementation of goats in different body condition and under increased photoperiod upon ovarian activity and preovulatory endocrine profiles. C. A. Meza H.*[1,3], M. E. Hernandez L.[1], J. G. Chavez-Perchez[2], H. Salinas[3], J. Urrutia M.[3], and M. Mellado[4], [1]*Universidad Autonoma Chapingo-URUZA,* [2]*Radiodiagnostico y Ultrasonografia,* [3]*INIFAP,* [4]*UAAAN*.

The effect of fat supplementation level (FSL) and body condition (BC) upon ovarian activity (OA) and the preovulatory serum profile of GH, LH and insulin (INS) in goats subjected to natural increases in photoperiod (March and April), was evaluated. The study was carried out in northern Mexico (25 NL, at 1,117 m). Goats, 14 months old, were classified as low body conditioned (LBC, n=10, 26.811.2 kg, BCS=3.0) or high BC (HBC, n=11, 33.81.2 kg, BCS=3.8), and received either no by-pass fat (NF) or Ca fatty acid salt (WF, 120 g hd d-1), equivalent to 0.768 Mcal NE, during a 42-d experimental period. Goats received a basal diet of alfalfa hay (2.0% BW, 14.6% CP), water, shade and mineral salts. Once synchronized (two PGF2a injections, 11 d apart), blood samples were collected during the late follicular phase of the second estrus at 15-min intervals for 6 h to quantify pulsatility (PULSE) and area under the curve (AUC) of GH and LH, as well as serum INS levels. The number of follicles (TF), corpus luteum (CL) and total ovarian activity (TF+CL=TOA) was scanned during the late luteal phase after blood sampling. No differences ocurred ($P>0.05$) for either FSL or BC with respect to TF (2.90.35) and CL (2.50.28). Average serum concentrations for LH, GH, and INS, were 3.460.55, 7.490.96 and 1.640.05 ng/mL, respectively. While GH-AUC (2791.2366.6), GH-PULSE (3.50.52), and LH-PULSE (3.70.7) did not differ ($P>0.05$) between BC and FSL, supplemented goats depicted the largest TOA (5.0 vs 6.00.28, $P=0.04$) with concomitant increases ($P=0.07$) in LH-AUC and INS. Fat-by pass supplementation of yearling goats with only 56% of adult weight during the anestrus season positively affected their metabolic status and the hypothalamic-hypophyseal-ovarian axis response.

Key Words: Goats, Energy, Ovarian activity

Production, Management, & the Environment Symposium: Impact of animal feeding operations on the environment

503 Overview of nitrogen in the environment. J. N. Galloway*, *University of Virginia*.

Nitrogen is essential for life but useable N is in short supply; thus ecosystem productivity is often limited by N availability. Historically, biological nitrogen fixation (BNF) was the primary process that converted unusable molecular diatomic nitrogen to useable reactive N (Nr). However, in the current world, human activities (Haber-Bosch process, cultivation-induced BNF and fossil fuel combustion) are now more important than natural BNF in creating Nr. In addition, since denitrification is not keeping pace with enhanced Nr creation, Nr is accumulating in the atmosphere, hydrosphere and biosphere. There are a large number of consequences on ecosystems and people that occur as enhanced Nr moves along its biogeochemical pathway. Referred to as the Nitrogen Cascade, the same nitrogen atom can cause sequential effects in the atmosphere, in terrestrial ecosystems, in freshwater systems, in marine systems, and on human health. This presentation will review the cycling of N in the natural environment, in contrast with the current environment, and will include projections for nitrogen cycling in the future. The Nitrogen Cascade will be used to illustrate the impacts of Nr on environmental systems. The presentation will address a challenge facing society–namely, while the consequences of Nr accumulation are severe, the introduction of Nr into agricultural systems is necessary to sustain food production. The challenge facing society is how to optimize nitrogen management in food (and energy) production while maintaining environmental quality.

Key Words: Nitrogen, Cascade, Fertilizer

504 Management to reduce nitrogen losses in animal production. C. Alan Rotz*[1], [1]*USDA / ARS*.

Reduction of N losses in animal production requires whole-farm management. Reduced loss from one component of the farm is easily negated in another component if all components are not properly managed. Animal excretion of N can be reduced by improving the balance of protein fed to that required by individual animals or animal groups or by improving production efficiency. Management to improve milk or meat production reduces the maintenance protein per unit of production, thus improving N utilization. Large losses of N occur on farms due to ammonia and nitrous oxide emissions to the atmosphere and nitrate leaching to ground water. Animal housing design and manure collection procedures influence the volatile loss in the housing structure. More frequent flushing or scraping of floors provides some reduction in loss, and experimental methods for separating feces and urine promise much greater reductions. Manure storage units are used to reduce application losses and improve the timing of nutrient application with crop needs. Maintaining a surface crust in storage tanks reduces volatile loss, and the use of covers or enclosed tanks can greatly reduce storage loss. Irrigation and surface spreading of manure without rapid incorporation often assures the loss of all remaining ammonia N. Rapid incorporation, band spreading, and shallow injection methods reduce this application loss, and deep injection into the soil essentially eliminates this loss. For grazing animals, the use of rotational grazing and half-day grazing practices can improve the distribution and utilization of manure nutrients. Reducing volatile losses between the animal and the soil can lead to greater leaching and denitrification losses if this additional N is not used appropriately. Use of a crop rotation that can efficiently recycle these nutrients and applying these nutrients near the time they are needed by the crop reduces the potential for further loss. Maintaining the proper number of animals per unit of land available for manure application is always critical for efficient recycling of nutrients with minimum loss to the environment.

Key Words: Nitrogen loss, Management, Farm system

505 Quantitative assessment of phosphorus transport to surface and groundwaters. J. L. Havlin*, *North Carolina State University, Raleigh, NC*.

National water quality survey data illustrate that increased eutrophication of fresh waters is related to increased P and N delivered from both non-point and point sources. As a result of increasing information and concerns regarding P delivery and water quality, the USDA-NRCS revised its nutrient management policy in May 1999 to reflect the potential contribution of P to water quality degradation. The policy requires each state to revise the Nutrient Management (590) standard in its Field Office Technical Guide. The revised standard must include an assessment of potential P loss from agricultural fields. As soil test P levels increase, through applications of animal waste and other P sources, the potential P delivery to surface and groundwater greatly increases. There are many interacting factors that influence P delivered from an agricultural field to surface or groundwater. These include the quantity and type of P applied, timing and method of application, soil type (soil chemical, physical, and biological properties), extent of soil erosion and sediment delivery, runoff and leaching potential, proximity to the water body, and other factors. We have developed a P Loss Assessment Tool (PLAT) that provides a means to assess the relative risk of P delivery to surface and groundwater. The PLAT is a "P index" method that was developed using the most current and relevant scientific data supporting P transport to surface and groundwaters. To quantify P delivered to surface and groundwater, PLAT includes four components or submodels: sediment bound or particulate P in surface runoff water, soluble P in surface water runoff, soluble P on leaching water, and P source contributions. The model also enables the user to evaluate how adoption of best management practices impact or reduce P loss. The quantitative estimates from each component are added to obtain an estimate of total P loss. These values are then assigned to categories of very high, high, medium, and low P loss. The presentation will discuss P loss pathways, technical components of PLAT, and an impact assessment of fields in North Carolina receiving animal waste.

Key Words: Water quality, Phosphorus

506 Animal management to reduce phosphorus losses to the environment. K. F. Knowlton*, *Virginia Polytechnic Institute and State University, Blacksburg, VA*.

Water quality in the United States is threatened by contamination with nutrients, primarily nitrogen and phosphorus. Animal manure can be a valuable resource for farmers, providing nutrients, improving soil structure, and increasing vegetative cover to reduce erosion potential. At the same time, application of manure nutrients in excess of crop requirements can result in environmental contamination. Environmental concerns with phosphorus are primarily associated with pollution of surface water (streams, lakes, rivers). This pollution may be caused by runoff of phosphorus when application to land is in excess of crop requirements. Increased specialization and concentration of livestock and crop production has led to the net export of nutrients from major crop producing areas of the country to areas with a high concentration of animal agriculture. Concentrated animal agriculture has been identified as a significant source of phosphorus contamination of surface water. Livestock utilize phosphorus inefficiently, excreting 60 to 80% of that consumed. The majority of phosphorus brought on to the farm in feed is land-applied in manure rather than being exported in meat or milk, and thus may runoff. Areas facing the dilemma of an economically important livestock industry concentrated in an environmentally sensitive area have few options. If agricultural practices continue as they have in the past, continued damage to water resources and a loss of fishing and recreational activity are almost inevitable. If agricultural productivity is reduced, however, the maintenance of a stable farm economy, a viable rural economy, and a reliable domestic food supply are seriously threatened. In this paper, animal management practices that reduce phosphorus losses from farms without impairing profitability will be reviewed.

Key Words: Phosphorus, Livestock management

507 Water quality and the grazing animal. R. K. Hubbard*[1], G. L. Newton[2], and G. M. Hill[2], [1]*USDA-ARS, Tifton, GA*, [2]*University of Georgia, Tifton, GA*.

Grazing animals and pasture production impact water quality both through urine and feces dropped by the animals and through fertility practices associated with production of high quality pasture. The two nutrients of primary concern relating to animal production are nitrogen (N) and phosphorus (P). Nitrogen is of concern because high concentrations in drinking water in the nitrate form cause methemoglobinemia (blue baby disease) while other forms of N (primarily nitrite) are considered to be potentially carcinogenic. Phosphorus in the orthophosphate form is of concern because it causes eutrophication of surface water bodies. The impact of grazing animals on soil and water quality is best evaluated at the watershed scale. Such evaluation must include both direct input of animal wastes from the grazing animal and also applications of inorganic fertilizers to produce quality pastures. Watershed scale studies have primarily used the approach of nutrient loadings per land area and nutrient removals as livestock harvests. A number of studies have measured nutrient loads in surface runoff from grazed land and compared loads with other land uses. Concentrations in discharge have been regressed against standard grazing animal units per land area. Watersheds with concentrated livestock populations have been shown to discharge 5 to 10 times more nutrients than watersheds with other land uses. Another major concern with animal production including grazing animals is pathogens, which may move from the wastes into surface water bodies. Major surface water quality problems associated with pathogens have been associated with grazing animals, particularly when they are not fenced out from the streams and farm ponds. This paper presents an overview of water quality findings and concerns relating to grazing animals.

Key Words: Nutrients, Pathogens, Surface runoff

508 Governmental policies and measures regulating agricultural nitrogen and phosphorus in the European Union. O. Oenema*, *Wageningen University and Research Center, Wageningen, The Netherlands*.

This paper discusses governmental policies and environmental regulations that influence nitrogen and phosphorus in animal manure and fertilizers in the European Union (EU-15). It starts with an introduction of changes in governmental policies during the last century. Secondly, it summarizes the basics of environmental policies and measures,

then summarizes the main characteristics of agriculture in the EU-15. Thirdly, it provides an overview of the common agricultural policy CAP in the EU and of environmental regulations and directives. Finally, it discusses implementation of the EU Nitrate Directive in the Netherlands and Denmark. Systematic interference of governments with European agriculture started in the 19th century. Marked effects of policies on agriculture followed after the foundation of the EU with its CAP. Environmental issues in agriculture were addressed following the reform of the CAP in 1992 and following the implementation of various environmental regulations and directives from the 1980's and 1990's onwards. The EU Nitrate Directive has as yet the strongest influence on N and P in agriculture, especially through its objectives to designate areas vulnerable to nitrate leaching, to establish action programs and to establish a code of good agricultural practice. These measures must ensure that, for each farm, the amount of N applied via livestock manure shall not exceed 170 kg per ha per year. The Nitrate Directive was agreed to by all member states in 1991, but there are variations between member states in the interpretation, implementation and enforcement of the Nitrate Directive. Differences in the progress of implementation appear in part to be related to differences in the structure of agriculture, as shown by a comparison between Denmark and The Netherlands.

Key Words: Nitrogen, Nitrate, Europe

Breeding & Genetics: Dairy cattle breeding for nonproduction traits

509 Selection for mastitis in Norwegian dairy cattle. A. Karlsen*[1], B. Heringstad[2], E. Sehested[1], and M. Svendsen[1], [1]*GENO Breeding and A.I. Association,* [2]*Department of Animal Science, Agricultural University of Norway.*

Clinical mastitis (CM) is the most frequent and costly disease in dairy production. Mastitis has been recorded through the health card system as an integrated part of the Norwegian Dairy Herd Recording System (NDHRS) since 1978, and includes recording of all veterinary treatments on individual cows. In 2002, 96% of the cows belonged to herds in the NDHRS. In Norway, antibiotics can only be prescribed by veterinarians, and it is compulsory to record diagnosis and treatment on the cow's health card. Information is then transferred to the NDHRS on routine basis. Mastitis has been included in the total merit index of Norwegian Dairy Cattle (NRF) since 1978, and the relative weight in the total merit index is currently 22%. In 2002, progeny testing for mastitis was based on an average of 210 daughters. Since 1990 there has been a favourable genetic trend for mastitis resistance. In 2002 the phenotypic average of CM (from 15 days prior to calving to120 days after first calving) was 11.5%. Results from a Norwegian selection experiment, including one group of cows selected for high protein yield (HPY) and one group selected for low clinical mastitis (LCM), clearly demonstrates the effect of direct and indirect selection on CM. After 3 cow-generations the genetic difference between LCM and HPY cows was 8.6 % CM. The genetic trend for the LCM cows, equivalent to a reduction of 0.9 % CM per year, shows that considerable selection response can be achieved for mastitis if sufficient selection pressure is put on the trait. If mastitis is ignored in the breeding program, selection for increased milk production will result in an unfavourable correlated response in CM. Results from the selection experiment indicate that an increase of 0.23 % CM per year may be expected as a correlated response. Genetic trends for the NRF population shows that with a broad breeding objective it is possible to obtain genetic improvement for health, fertility, and milk production simultaneously, despite unfavourable genetic correlations and low heritabilities for some of the traits.

Key Words: Mastitis resistance, Selection, Norwegian dairy cattle

510 Associations of lactoferrin concentrations in milk with indicators of mastitis in dairy cows. A. A. Martin*, M. A. Faust, L. J. Rowe, and E. J. Lonergan, *Iowa State University, Ames 50011.*

Objectives were to determine levels of lactoferrin in milk and associations of lactoferrin with mastitis indicators. Milk samples were collected from 180 Holstein cows in the Iowa State University genetic research herd. For each cow, one 60 ml aliquot was evaluated for milk constituents by a commercial milk testing laboratory, and one 5 ml aliquot was frozen immediately for subsequent analysis for lactoferrin. Lactoferrin in milk was quantified by sandwich ELISA (Bethyl Laboratories, TX). A standard curve ranging from 7.8 - 500 ng/ml lactoferrin was used on each plate. Milk samples were diluted at 1:2000 (milk:diluent) in 10% Tween 20, 1% BSA, 50 mM Tris pH 8.0. Detection antibodies were conjugated with horseradish peroxidase. The substrate, 3,3',5,5'-tetramethyl-benzidine, was used to detect the bound detection antibodies. Samples were read in a microtiter plate at a wavelength of 450 nm. Detailed mastitis treatment records for 2002 were acquired and used to determine incidence of mastitis, number of days treated, and mastitis severity for individual cows. Projected mature equivalent fat corrected milk (FCM) and lactation average somatic cell score (SCS) were obtained from Dairy Herd Improvement records. Means for mastitis incidence, days treated, and lactation average SCS were .94, 19.3, and 3.2, respectively. Several chronic cows skewed results for days treated consequently this variable was transformed using the natural log function. Mean lactoferrin was .336 mg/ml (SD = .222 mg/ml). Highest FCM was associated with lowest concentration of lactoferrin in milk. Lactoferrin levels were lowest for youngest cows ($P < .01$). Stage of lactation was not important for lactoferrin concentration when cows with 10 or fewer days in milk were eliminated from the analysis. Correlations of mastitis indicators with lactoferrin and SCS measures were similar and indicated that highest days treated was associated with highest lactoferrin and highest SCS ($P < .05$). Correlation of lactoferrin and lactation average SCS was .36. In this small data set, heritability for lactoferrin was considerably higher than estimates for SCS related measures. Lactoferrin may be useful for genetic selection to control increases in mastitis that accompany selection for high yields.

Key Words: Lactoferrin, Mastitis, Somatic cell score

511 Measure of the impact of somatic cell count on longevity of Holstein and Jersey cows using survival analysis. D. Z. Caraviello*, K. A. Weigel, G. Shook, and P. Ruegg, *University of Wisconsin - Madison.*

Survival analysis through a Weibull proportional hazards model was applied to evaluate the effect of somatic cell count (SCC) on survival of 1,892,919 Holstein and 250,835 Jersey cows with first calving from 1990 to 2000 in the United States. Herds were divided in 5 levels for Holsteins (2 replicates per level) and 3 levels for Jerseys by average somatic cell count. Survival was defined as days from first calving until culling or censoring corrected for 305-d mature equivalent milk production. Our model included time-dependent effects of herd-year-season, parity-stage of lactation and within-herd-year quintiles for mature equivalent milk production, as well as the time-independent effect of age at first calving. Different rho and gamma parameters for the Weibull distribution were estimated for each of the herd levels. SCC was divided into 15 classes and its impact on functional survival, after accounting for all other factors listed above, was evaluated. Survival analysis methodology allowed a nonlinear relationship between SCC and longevity. Average censoring and failure time decreased as average SCC level of the herd increased. Results showed differences between levels of herds in the risk of culling; cows in the high SCC class had 3.4, 2.7, and 2.3 for Holsteins and 4.0, 2.9 and 2.2 for Jerseys times higher risk of being culled than cows in the average SCC class in herds with low, medium and high average SCC, respectively. This suggests stricter culling for SCC in herds with low average SCC. Cows in the lowest class for SCC also showed higher risk of culling than cows in the average SCC class, particularly in herds with high average SCC.

Key Words: Survival analysis, Somatic cell count, Longevity

512 Effect of synchronization protocols on genetic parameters of reproductive traits in dairy cattle. R. C. Goodling*[1], G. E. Shook[1], K. A. Weigel[1], N. R. Zwald[1], and R. D. Welper[2], [1]*University of Wisconsin-Madison,* [2]*Alta Genetics, Inc.*

Genetic evaluation for female reproduction is one strategy for improving performance. Many producers utilize synchronization of ovulation or estrus to manage reproduction. Our objective was to examine the effects of synchronization protocols on parameter estimates of days to first breeding (DFB). Data were collected from producers participating in an AI progeny testing program, and utilizing DC305 herd management software to record reproductive treatments and events. Analysis was performed on 13,134 records from 42 herds. Data were split into