

TMR, in which the forage component was grass and maize silage (non-GM) in a 1:3 DM ratio and formed 55% of the TMR DM. In study weeks 1-3 the TMR DM also contained non-GM supplements of 18.5% cracked wheat, 26.1% rapeseed meal and 0.4% minerals. In weeks 4-12 ground maize grain (MON810) replaced cracked wheat. Milk and TMR samples were taken weekly prior to and after the introduction of the GM diet. In milk samples spiked with Bt DNA, PCR analyses established a minimum detection level (MDL) of transgenic DNA, of 7.5 g/l of milk. Subsequent semi quantitative PCR analyses were carried out in duplicate on TMR and milk samples using three primer sets to establish the presence of GM DNA. Two of the maize primer sets recognise different regions of the Cauliflower Mosaic Virus (CaMV) 35S promoter and the third covers the integration site of the MON810 inserted DNA. The PCR analysis was capable of detecting GM DNA fragments greater than or equal to 200 base pairs (bp) in length. The feed and milk samples analysed at week 3 when cows received a TMR containing no GM feed ingredients were negative. The TMR feed samples at weeks 4 and 12 were positive for MON810 maize DNA, but all milk samples were negative. In conclusion the results show that GM DNA could not be detected in milk (MDL 7.5 g/l of milk) from cows receiving 18.5% of their diet DM as insect protected (MON810) maize grain. The study was funded by the Milk Development Council and the Dairy Industry Federation.

Key Words: Dairy cows, GM feed ingredients, Transgenic DNA

477 Assessment of novel feeds in animal nutrition. Karen Aulrich* and Gerhard Flachowsky, *Institute of Animal Nutrition, Federal Agricultural Research Centre.*

Apart from feed safety assessment including safety for consumers, animals and environment, nutritional assessment of feeds produced using recombinant DNA techniques (Genetically Modified Organism, GMO) is necessary. In 1997 we started a program to assess GMO's of the so-called first generation (feed plants with changed tolerance or resistance and with minor changes in content of valuable and desirable ingredients) including Bt-corn, Pat-corn, Pat-sugar beets and Gt-soybeans. Apart from main nutrients (crude protein, ether extract, crude fiber, crude ash), amino acids, fatty acids, minerals, fiber components and some mycotoxins were determined in seeds of corn and soybeans, sugar beets and silages from corn and sugar beet leaves. Digestion and feeding experiments were carried out with broilers (Bt-corn), layers (Bt-corn, Pat-corn), pigs (Bt-corn, Pat-corn, Pat-sugar beets, soybeans), sheep (Bt-corn silage, Pat-corn silage, Pat-sugar beet silage), growing bulls (Bt-corn silage) and fistulated cows (Bt-corn silage). Digestibility of nutrients, performance of animals and fate of DNA were investigated. Up to now, we did not find significant differences in nutritional assessment and food quality between feeds from isogenic and transgenic plants of the first generation, except a lower mycotoxin-content (deoxynivalenol and zearalenon) in Bt-corn. The so-called substantial equivalence could be demonstrated. Fragments of plant DNA could be detected in some animal tissues (e.g. muscle from chicken), but fragments of transgenic

DNA were not found. It may be assumed that the transfer of DNA fragments in the body is a process, which takes place constantly and consequently, but it is not a specific problem of genetic engineering. However, the subject should be pursued further. From the point of view of animal nutrition, further studies seem to be necessary on the following subjects: - Nutritional assessment of GMO's with substantial changes in composition (GMO's of second generation) - Influence of GMO's upon animal health and product quality.

Key Words: Novel feeds, Animal nutrition, Genetically modified organism

478 Differences in Transfer of Nicarbazine, Meticlorpindol and Ivermectin from Feed to Milk. C.A. Kan*¹, C.A.J. Hajee², J.A. van Rhijn², A. Klop¹, T. Zuidema², B.J.A. Berendsen², and H.J. Keukens², ¹*ID TNO Animal Nutrition, P.O. Box 65, 8200 AB Lelystad, The Netherlands,* ²*RIKILT, P.O. Box 230, 6700 AE Wageningen, The Netherlands.*

Cross contamination during feed production may result in contamination of feeds with feed additives or veterinary drugs. This may lead to contamination of milk, but the extent to which residues might occur was not known. We carried out carry-over experiments with nicarbazine, meticlorpindol and ivermectin. 6 Groups of 4 cows each (both high [> 35 kg/day] and low [< 20 kg/day] producing ones) received concentrate artificially contaminated at three different levels. The high-producing cows received 12 kg and the low producing ones 2 kg concentrate per cow per day. The contaminated feed was fed for three weeks. During exposure and at least 7 days post-exposure, milk samples were collected and mixed samples per group were analysed. Two cows (one high and one low producing one) served as controls. Milk samples were analysed by validated HPLC methods with UV or fluorescence detection. The LOQ in milk for nicarbazine and meticlorpindol was 25 ng/g and for ivermectin 0.1 ng/ml. Feed levels were in the 1-12.5 mg/kg range for nicarbazine, in the 2.5-25 mg/kg range for meticlorpindol and in the 0.3-3 mg/kg range for ivermectin. Nicarbazine (measured as DNC) could not be detected in any of the milk samples. Very low levels could be detected in body fat samples of some animals slaughtered after about 8 days withdrawal. Meticlorpindol was found in milk at levels between 5 and 50 ng/g during feeding the contaminated feed only. The levels scattered, but generally a dose-response relationship between levels in feed and in milk could be established. Ivermectin was found in milk throughout the whole exposure period and up to 10 days post-exposure. Levels up to 7 ng/g were found and good dose-response relationships between feed and milk level could be established. These data show that absorption from feed and excretion into milk of these three compounds in dairy cows differed considerably. No general pattern could be deduced from these data and no general conclusion on risks of residues in milk due to cross contamination in feed mills could be drawn.

Key Words: Nicarbazine in milk, Meticlorpindol in milk, Ivermectin in milk

ASAS/ADSA Physiology: General Physiology

479 Lutalyse alters the immune response in sows after intrauterine inoculation with bacteria. M. C. Wulster-Radcliffe*¹, R. C. Seals², and G. S. Lewis¹, ¹*USDA-ARS United States Sheep Experiment Station,* ²*University of Virginia.*

During luteolysis, increases in PGF_{2α} and decreases in progesterone lead to clearance of uterine infections. Thus, we conducted an experiment to determine whether Lutalyse, a PGF_{2α} analogue, alters the uterine immune response to bacterial challenge in the absence of luteolysis and the concomitant decrease in progesterone. Sows (n = 6/group) were assigned to treatments in a 2 × 2 factorial array; bacterial challenge and Lutalyse were main effects. Vena caval blood was collected daily on d 7 through 11 of the estrous cycle. On d 7, uteri were inoculated with either PBS or 70 × 10⁷ cfu of *Escherichia coli* and 150 × 10⁷ cfu of *Arcanobacterium pyogenes* in PBS (10 mL). On d 9, saline (2 mL) or Lutalyse (10 mg) was injected i.m. On d 11, uteri were collected. Sediment (packed-cell volume; PCV) and ability to culture *E. coli* and *A. pyogenes* from uterine flushings were used to diagnose infections. Differential white blood cell counts and basal and mitogen-stimulated lymphocyte proliferation were used to evaluate immune function. All bacteria-treated sows developed uterine infections. Sows treated with bacteria and Lu-

talyse had less severe infections than sows treated with bacteria and saline (PCV = 25 vs 67%; P < 0.01). No PBS-treated sows developed infections (PCV < 5%). Neither Lutalyse nor bacteria affected progesterone (64 ng/ mL) or estradiol-17β (< 1 ng/mL), indicating that luteolysis did not occur. Basal (10.2 vs 2.3 pmol) and lipopolysaccharide-stimulated incorporation (6.8 vs 2.9 pmol) of [³H]thymidine into newly formed lymphocytes was greater (P < 0.01) for Lutalyse-treated than for saline-treated sows. Lutalyse, compared with saline, increased vena caval PGF_{2α} (0.44 vs 0.28 ng/mL; P < 0.05), and Lutalyse increased neutrophils (65 vs 84/100 WBC; P < 0.01) and decreased lymphocytes (28 vs 16/100 WBC; P < 0.01). Thus, exogenous PGF_{2α} can initiate clearance of uterine infections without inducing luteolysis and decreasing progesterone and (or) increasing estradiol-17β concentrations; effects of PGF_{2α} seem somewhat independent of changes in progesterone and estradiol-17β.

Key Words: Infection, Sow, Lutalyse

480 Lutalyse can up-regulate the uterine immune system in the presence of progesterone. G. S. Lewis* and M. C. Wulster-Radcliffe, *USDA-ARS United States Sheep Experiment Station.*

In luteal-phase ewes with uterine infections, Lutalyse, a PGF_{2α} analogue, treatment induces luteolysis and clearance of the infections. However, the direct effects of Lutalyse on uterine infections and its effects through luteolysis (i.e., decreased progesterone [P4]) are completely confounded. Thus, this experiment was conducted to determine whether Lutalyse alters the uterine immune response if P4 is maintained. Ewes (n = 8/group) were assigned to treatments in a 2 × 2 × 2 factorial array; ovariectomy, P4 treatment, and Lutalyse were main effects. On d 0 of the estrous cycle, ewes were either sham ovariectomized or ovariectomized. After ovariectomy, either sesame oil (2.5 mL) or P4 (5 mg) in oil was injected i.m. twice daily. On d 6, uteri were inoculated with 70 × 10⁷ cfu of *Escherichia coli* and 150 × 10⁷ cfu of *Arcanobacterium pyogenes* in PBS (5mL). On d 9, saline (2 mL) or Lutalyse (15 mg) was injected i.m. Vena caval blood was collected daily on d 9 through 11, and uteri were collected on d 12. Sediment (packed-cell volume; PCV) and ability to culture *E. coli* and *A. pyogenes* from uterine flushings were used to diagnose infections. Basal and mitogen-stimulated lymphocyte proliferation were used to evaluate immune function. All ewes developed infections. However, compared with controls, infections were less severe (P < 0.01) in the absence of ovarian or supplemental P4 (PCV = 7 vs 15%) or after Lutalyse (PCV = 8 vs 15%). Basal and concanavalin A (Con A)- and lipopolysaccharide (LPS)-stimulated lymphocyte proliferation increased over time (P < 0.01). Basal (1.356 vs 1.710 optical density units [OD]) and Con A- (2.18 vs 2.47 OD) and LPS-stimulated proliferation (1.75 vs 2.12 OD) were greater (P < 0.01) for Lutalyse than for saline-treated ewes. Basal proliferation was less (P < 0.01) for P4- than for oil-treated ewes. After ovariectomy, Con A-stimulated proliferation increased (2.23 vs 2.41 OD; P < 0.05). We conclude that exogenous PGF_{2α} can initiate clearance of uterine infections, independent of inducing luteolysis and decreasing P4 concentrations.

Key Words: Lutalyse, Sheep, Infection

481 Incidence of anestrus in suckled beef and milked dairy cattle. J.S. Stevenson*, *Kansas State University.*

Early conception of suckled cows is limited by the proportion of cows that are cycling at the beginning of the breeding season. Although prolonged anestrus generally is not limiting in milked cattle, negative energy balances are associated with prolonged anestrus. In more than 2,200 beef cows studied, body condition (BC), parity, and days in milk (DIM) influenced the proportion of cows cycling (cyclicality; determined by measuring blood progesterone) before the onset of the breeding season. As BC increased from <4 to >5.5 (1 = thin and 9 = fat), cyclicality increased (P<0.05) by 18.2% for each unit increase in BC. Cyclicality increased linearly from 25% (<50 d) to a peak after 70 DIM (60%). For every 10-d interval from <50 to >80 d, cyclicality increased (P<0.05) by 7.5.07%. Compared to older cows (53%), fewer (P<0.01) 2-yr-old cows with their first calves were cycling (44%), despite calving up to 3 wk earlier. Dairy cows on three farms were studied (milk yields ≥10,000 kg). In one study of 678 cows (milked 2× daily), the average cyclicality was 82% by 40 to 68 DIM. In first-lactation cows, cyclicality was lower (P<0.05) in one herd (72%) than in the second herd (87%), whereas no differences were detected for older cows (88 vs. 86%). Body condition (1 = thin and 5 = fat) assessed at time of blood sampling averaged 2.3.05. For each 0.5-unit increase in BC, cyclicality increased (P<0.01) by 4.6.22%. For each 10-d increase in DIM, cyclicality increased (P<0.01) by 6.1.17%. In a second study of 251 cows in one herd (milked 3× daily), cyclicality was only 44% by 47 to 67 d. First vs. later lactating cows (40 vs. 55%) were less (P < 0.05) likely to be cycling. Again, BC averaged about 2.3.05. As BC increased by 0.5 units, cyclicality increased (P<0.05) by 24.3.49%. Milk yield had no influence on cyclicality. In the last study of 367 cows in three herds (milked 2× daily) during the summer, cyclicality was 84% by 56 to 83 d. In this study, lactation number did not affect cyclicality, but BC (average of 2.4.05) increased (P<0.05) cyclicality by 8.5.23% for every 0.5-unit increase in BC. Further, suckled and milked cows not cycling by the beginning of the breeding period conceived at lesser rates and took longer to eventually conceive.

Key Words: Anestrus, Suckled cows, Milked cows

482 Plasma and luteal progesterone influence *in vivo* embryo development in day 5 post-estrus Holstein Friesian cows. MP Green*¹, MG Hunter¹, and GE Mann¹, ¹*University of Nottingham, Loughborough, Leicestershire, UK.*

Previous studies have demonstrated a close relationship between maternal progesterone and degree of embryo development on day 16 in dairy cows. The aim of the present study was to relate stage of embryo development on day 5 post-estrus to maternal progesterone secretion. Twenty Holstein Friesian cows (parity 1-9) were inseminated at synchronised estrus. Animals were slaughtered on day 5 post-oestrus, (estrus=Day 0) blood samples taken, CL removed and oviducts and uteri flushed. In total, 11 animals (55%) had 15 potentially viable embryos (4 double ovulations). A potentially viable embryo was defined as being intact; non-viable embryos were those with broken or empty zones. Viable embryos collected (n=15) were found to be at a range of development stages; 8-cell (n=7), 9-16 cell (n=4) and morula (n=4). Up to the morula stage all embryos were in the oviduct. Morulae were recovered from the uterus from two of the three animals. Mean plasma progesterone, luteal weight and progesterone concentrations (n=11) were 1.2ng/ml ±0.6ng/ml, 1.8g ±0.9g and 30.2µg/CL ±15.8µg/CL respectively. Plasma progesterone concentrations and progesterone:oestradiol ratio within animals increased significantly (p<0.001) over and between (p<0.05) the three developmental stages recovered. CL weight (p<0.05) and progesterone content µg/CL (p<0.01) increased significantly with stage of embryo development. Moreover, linear regression analysis demonstrated day 5 plasma progesterone increased significantly with CL weight (p<0.01) and luteal progesterone content (µg/CL) (p<0.01). The results demonstrate a close relationship between the degree of embryo development and both plasma and luteal progesterone as early as day 5. This provides further evidence that progesterone is fundamental to early embryo development and survival in the dairy cow. (Funded by Ministry of Agriculture Fisheries and Food, UK)

Key Words: Progesterone, Corpus luteum, Embryo

483 Effects of high plasma urea nitrogen levels on bovine embryo quality and development. M. L. Bode*, R. O. Gilbert, and W. R. Butler, *Cornell University, Ithaca, NY.*

Lactating dairy cows (n = 23) were fed diets designed to result in plasma urea nitrogen (PUN) levels either <19 mg/dL (LD; n = 12) or >19 mg/dL (HD; n = 11). After 30 days on diets, the cows were synchronized for estrus and superovulated in preparation for embryo flushing. Concentrations of PUN were 16.1 and 24.1 mg/dL for LD and HD cows, respectively. Embryos were recovered non-surgically on day 7 after estrus and evaluated for quality and stage of development. Embryos graded as 1 or 2 (n = 96) were frozen for direct transfer to heifer recipients. Virgin heifers (n = 122; 12 to 20 months of age) were fed diets designed to result in either low or high PUN levels (LR, HR; PUN of 8.1 and 25.1 mg/dL for LR and HR, respectively). After 30 days on diets, the estrous cycles of the heifers were synchronized. Embryos were transferred on day 7 after estrus to heifers that exhibited a palpable corpus luteum, forming four experimental groups (HD/HR, HD/LR, LD/HR, LD/LR). There were no differences in the quantity, visual quality, or stage of development of embryos collected from LD cows or HD cows. However, the embryos from the LD cows resulted in a higher pregnancy rate than the embryos from HD cows (35.1% versus 11.1% for low and high PUN, respectively; P < 0.02). Neither the diet of the heifer receiving the embryo or the combination of the donor and recipient diets had a significant effect on pregnancy rate (P > 0.05). In a second experiment, heifers (n = 39) continuing on the same low and high PUN diets as the embryo recipient heifers were synchronized for estrus and artificially inseminated. The circulating level of PUN did not affect the pregnancy rate (P > 0.95). The results of this study indicate that high PUN levels in lactating dairy cows on or before day 7 of pregnancy is deleterious to the viability of the embryo. High PUN in heifers did not affect pregnancy rate, suggesting interaction of high PUN with other conditions in cows *eg.* negative energy balance. However, further research is necessary to determine the mechanism(s) for this detrimental effect.

Key Words: cows, embryo, urea

484 Early gestational modification of conceptus development in sheep. M. E. Wilson*, B. A. Costine, and E. K. Inskip, *West Virginia University*.

The importance of the early uterine environment in determining conceptus growth and survival in livestock species is becoming more evident. These studies were conducted to determine if early gestational treatment with growth hormone could influence lamb birth weights and if treatment with estradiol would influence IGF-I content in the uterine lumen. In experiment I, estrus was synchronized with CIDR devices, inserted for 14 d, and ewes were assigned at random to receive either no treatment (n = 20) or 154 mg of recombinant bovine growth hormone (Posilac; n = 20) at the withdrawal of progesterone. Ewes were housed with fertile rams at a ewe:ram ratio of 12:1 and mating was recorded. Blood samples were collected on d 6 after estrus for quantification of progesterone and both free and total IGF-I. Each ewe was examined by transrectal ultrasonography 40 d after estrus for determination of pregnancy and enumeration of the fetuses present. At lambing, type of birth, birth weight and sex of each lamb were recorded. In experiment II, 16 ewes (n = 4 per treatment) were assigned to receive 0, 125, 250 or 500 g of estradiol on d 5 and 6 after mating (d 0 is estrus). Uterine luminal contents were collected on d 7 after mating for determination of IGF-I content. Treatment with growth hormone did not alter circulating concentrations of progesterone 6 d after estrus (2.6 ± 0.2 ng/ml, $P > 0.10$). However, growth hormone increased ($P < 0.001$) both free (0.70 ± 0.04 vs 4.37 ± 0.68 ng/ml) and total (177 ± 13 vs 490 ± 5 ng/ml) circulating IGF-I 6 d after estrus. Treatment of ewes with bovine growth hormone prior to breeding tended to increase ($P < 0.07$) birth weight of lambs (5.1 ± 0.2 kg vs 4.5 ± 0.2). Treatment of ewes on d 5 and 6 of gestation with 125 and 250 g of estradiol did not increase uterine luminal IGF-I content (5.5 ± 2.2 and 6.1 ± 1.7 ng) when compared to controls (8.4 ± 1.5 ng). However, 500 g of estradiol resulted in an increase ($P < 0.05$; 14.4 ± 2.5 ng) in uterine luminal IGF-I content when compared to controls. These data support our suggestion that modulation of early uterine environment with growth hormone, and potentially estradiol, may modify conceptus development.

Key Words: Ewe, Pregnancy, Conceptus development

485 Use of recombinant GnRH antigens for immunosterilization of beef heifers. T. W. Geary*¹, E. E. Grings¹, M. D. MacNeil¹, S. E. Bellows¹, K. P. Bertrand², D. M. de Avila², and J. J. Reeves², ¹USDA-ARS, Fort Keogh LARRL, Miles City, MT, ²Washington State University, Pullman.

Beef heifers (n = 47) were allotted by age (mean = 8.5 mo) and weight (mean = 238 kg) to evaluate immunosterilization with one of three different GnRH antigens or control. Each heifer received a primary immunization at wk 0 and booster immunizations at wk 6 and 12 containing 1 mg of protein in 1 mL of adjuvant administered in the mammary gland. Heifers were immunized against either a fusion protein consisting of thioredoxin with seven GnRH peptides (tGnRH), a fusion protein consisting of ovalbumin with seven GnRH peptides (oGnRH), a cocktail of tGnRH/oGnRH, or a cocktail containing thioredoxin and ovalbumin (control). Six heifers within each treatment received Synovex H implants at wk #2. Weekly blood samples were collected from wk #2 to 26 to determine serum progesterone concentrations and GnRH antibody titers. GnRH antibody titers increased after the first booster injection, peaked after the second, and remained elevated through the end of the study for GnRH immunized heifers ($P < 0.01$). Heifers that were immunized against oGnRH had greater ($P < 0.05$) GnRH antibody titers than tGnRH heifers but did not differ ($P = 0.20$) from tGnRH/oGnRH heifers. Estrous cycles were suppressed ($P < 0.05$) in 10/12, 12/12, 11/12 and 0/11 tGnRH, oGnRH, tGnRH/oGnRH, and control heifers, respectively. At slaughter, uterovarian weights were lighter ($P < 0.01$) for GnRH immunized heifers than controls. Synovex H implanted heifers had greater ADG from wk 6 to 26 and wk #2 to 26, greater REA, and lower %KPH, yield grade, and quality grade than non-implanted heifers. We conclude that immunization against the tGnRH, oGnRH and tGnRH/oGnRH fusion proteins produced anti-GnRH antibodies that suppressed estrous cycles in 83, 100 and 92% of heifers, respectively, without affecting feedlot or carcass performance. Implanting heifers with Synovex H improved ADG, REA, and yield grade. Protocols that yield greater than 95% estrous suppression may someday replace surgical spaying of heifers.

Key Words: GnRH, Heifers, Sterilization

486 Induction of the "ram-effect" and response to estrus induction procedures in Fall born ewe lambs. M. Knights*¹, Q. S. Baptiste¹, and P. E. Lewis¹, *West Virginia University, Morgantown, WV*.

The ability of ram introduction (RI) to induce the "ram-effect" and the ability of progesterone (P4) pre-treatment and RI to induce estrus and ovulation in Fall born lambs during the anestrus season was investigated. In early July lambs of mixed breeds (41.8 ± 0.6 kg and 250.7 ± 1.3 d) were assigned to be untreated (C, n=7), introduced to rams (7:1 ewe:ram ratio; R, n=7), treated with a CIDR device for 5 d (P, n=5), treated with a CIDR device and introduced to rams at CIDR removal (PR, n=11), or given estradiol (25 mg, E2b i.m.) 24 h after CIDR withdrawal/RI (PER, n=11). Blood samples were collected from lambs in groups R, P and C every 4 h for 60 h from RI/CIDR withdrawal (0 h), to characterize the LH surge profile and in groups R and C every 15 minutes from 12 to 20 h for determination of LH pulse frequencies. Ultrasonographic examinations of the ovaries were conducted at 0, 36 and 60 h. Observations for estrus was done every 4 h from 0 to 60 h. Lambs in group R had a higher LH pulse frequency than C lambs ($P < 0.01$; 7.7 ± 0.5 and 2.7 ± 0.8 pulses/8h for group R and C, respectively). More lambs in the R group than in P or C groups showed an LH surge and ovulated ($P < 0.05$; 7/7 vs 0/5 and 0/7, and 6/7 vs 0/5 and 0/6 for groups R, P and C, respectively). Diameter of the largest follicle at 0 h (3.2 ± 0.1 mm) was not different among groups. Growth rate of the largest follicle between 0 and 36 h was greater in RI groups than group C ($P < 0.05$; 1.5 ± 0.2 , 1.3 ± 0.3 , 0.86 ± 0.3 , -0.11 ± 0.6 mm/d for lambs in R, PR, PER, and C groups). Diameter of the largest follicle at 36 h was 5.6 ± 0.2 , 5.1 ± 0.5 , 4.3 ± 0.4 , and 4.0 ± 0.6 for lambs in R, PR, PER, P and C groups, respectively and was larger ($P < 0.05$) in R than PER, P and C, and in PR than P groups. Number of follicles 3 mm was not different among groups at 0 (1.6 ± 0.1) or 36h (1.3 ± 0.5), but was greater at 60 h in C (1.7 ± 0.4) than in R (0.7 ± 0.2), PR (0.6 ± 0.2) and PER (0.3 ± 0.2) groups. Estrus was observed in 73, 45 and 0 % of lambs in PER, PR and R groups, respectively, and was greater ($P < 0.05$) in P4 pre-treated lambs (PER and PR) than R lambs. During seasonal anestrus, fall born ewe lambs show a typical "ram-effect" response to RI further, P4 pre-treatment and RI when combined with E2 results in a high estrus response.

Key Words: Fall born ewe lambs, Ram-effect, Anestrus

487 Uterine responses to a graded dose of genistein in postpubertal gilts. J.A. Ford, Jr.* and W.L. Hurley, *University of Illinois, Urbana, Illinois*.

Phytoestrogens can affect the reproductive tract in some mammalian species. The objectives were to characterize the change in uterine wet and dry weights in gilts following administration of a graded dose of the soybean phytoestrogen, genistein. Twenty postpubertal gilts were ovariectomized in order to remove endogenous estrogen. The gilts were randomly assigned to one of five treatment groups 15 d post ovariectomy. Genistein was solubilized in DMSO prior to mixing with peanut oil vehicle. Treatment groups received either no hormone (G0) or genistein at 50 mg / d (G50), 100 mg / d (G100), 200 mg / d (G200), or 400 mg / d (G400). Treatments were administered by IM injection at 12-h intervals for 10 d. Gilts were slaughtered after the 10 d of injections. Uteri were collected at the time of slaughter, trimmed of all extraneous tissue, and weighed. Dry weights were determined by freeze-drying a portion of the sample. Uterine wet weight increased as the dosage of genistein increased ($p < .01$; 103.1 ± 43.8 g for G0, 108.7 ± 33.6 g for G50, 108.5 ± 23.8 g for G100, 174.0 ± 34.7 g for G200 and 249.5 ± 70.7 g for G400). Uterine wet weight standardized for body weight increased as the dosage of genistein increased ($p < .01$; 71.3 ± 28.1 g / 100 kg BW for G0, 78.1 ± 21.2 g / 100 kg BW for G50, 78.8 ± 14.6 g / 100 kg BW for G100, 126.4 ± 19.9 g / 100 kg BW for G200 and 171.2 ± 48.1 g / 100 kg BW for G400). Uterine dry weight increased as the dosage of genistein increased ($p < .03$; 17.3 ± 7.6 g for G0, 19.5 ± 3.5 g for G50, 20.7 ± 5.9 g for G100, 27.9 ± 6.6 g for G200 and 35.6 ± 8.2 g for G400). Uterine dry weight standardized for body weight increased as the dosage of genistein increased ($p < .02$; 11.9 ± 4.9 g / 100 kg BW for G0, 13.5 ± 2.1 g / 100 kg BW for G50, 14.4 ± 3.8 g / 100 kg BW for G100, 20.0 ± 3.8 g / 100 kg BW for G200 and 24.5 ± 5.5 g / 100 kg BW for G400). Hydration percentage was unchanged in the uterine samples ($p > .26$; 83.5 ± 1.4 % for G0, 84.4 ± 1.9 % for G50, 82.1 ± 2 % for G100, 84.2 ± 1.2 % for G200 and 85.1 ± 0.8 % for G400). A graded dose of genistein causes a significant

increase in uterine wet and dry weights, but does not change the proportion of water in uterine tissue in ovariectomized postpubertal gilts. Administration of high doses of the soybean phytoestrogen, genistein, may affect reproductive tract development and function.

Key Words: gilt, phytoestrogen, uterus

488 Pancreatic insulin response and tissue responsiveness to insulin in dry cows, lactating cows and cows suffering from fatty liver: results of hyperglycemic and hyperinsulinemic euglycemic clamp experiments. M. Kaske*, K. Herzog, S. Kraeft, and J. Rehage, *Clinic for Cattle, School of Veterinary Medicine, D - 30173 Hannover, Germany.*

First objective was to study the pancreatic insulin response to glucose in 5 dry cows (mean \pm SEM: 38 \pm 11 d ap), 5 lactating cows (47 \pm 11 d pp; 28 \pm 2 kg milk/d) and 5 early-lactating cows suffering from fatty liver (increased liver enzymes, liver triglycerides > 50 mg/g; 20 \pm 2 d pp). During the euglycemic clamp, blood glucose was clamped at 4 mM for 2 h by adapting glucose infusion rate according to the blood glucose concentration measured every 5 min. Plasma insulin and non-esterified fatty acids (NEFA) were analyzed repeatedly. The amount of glucose necessary to clamp blood glucose was higher for lactating cows than for dry cows and fatty liver cows (15.5 \pm 1.6, 9.8 \pm 1.4, 10.1 \pm 2.5 μ mol/kg/min, respectively). The pancreatic insulin response to glucose infusion was twice as high in dry cows (steady-state plasma insulin during glucose infusion about 30 μ U/ml) than in lactating cows and fatty liver cows which reached comparable steady-state insulin concentrations during glucose infusion (about 15 μ U/ml). In all groups, irrespectively of marked differences in the basal NEFA concentrations, NEFA dropped during glucose infusion by about 40 %. Second objective was to compare the responsiveness of peripheral tissues to insulin. Each 5 or 6 dry cows (22 \pm 2 d ap), lactating cows (42 \pm 7 d pp), early-lactating fatty liver cows (21 \pm 3 d pp) and early-lactating ketotic fatty liver cows (plasma hydroxybutyrate > 1.5 mM; 18 \pm 5 d pp) received bovine insulin intravenously in amounts of 0.1, 0.5, 2.0, 5.0 and 10.0 mU/kg/min consecutively for 2 h each. Blood glucose was clamped at the basal level by infusing varying rates of glucose. The maximal insulin response defined as the mean steady-state glucose infusion rate during infusion of 10 mU insulin/kg/min was higher in lactating cows than in dry cows; the response was further reduced in fatty liver cows and lowest in ketotic fatty liver cows (35.8 \pm 3.0, 28.2 \pm 0.7, 22.4 \pm 1.3, 14.5 \pm 1.4 μ mol/kg/min, respectively). It is suggested that the insulin resistance of fatty liver cows could be due to post-binding defects in insulin action and/or a depletion of GLUT-4. Results further emphasize that basal plasma concentrations of insulin do not reflect the extent of insulin resistance in cows.

Key Words: Insulin, Clamp, Fatty liver

489 Effect of feeding level on rumen papillae is mediated by IGF-1. Zan-Ming Shen^{1,2}, Berthold Lhrke¹, Falk Schneider¹, Hartmut Franz¹, Arthur Chudy¹, Siegfried Kuhla¹, Rudolf Zitnan^{1,4}, Holger Martens³, and Hans Hagemeister¹, ¹Research Institute for Biology of Farm Animals Dummerstorf, Germany, ²Nanjing Agriculture University, China, ³Berlin Free University, Germany, ⁴Research Institute of Animal production Nitra, Slovakia.

Eight male goats (4-month) were individually fed with grass hay (ad lib.) and concentrate 1.1 kg/d (HL) or 0.3 kg/d (LL) for 41-d to study the effect of feed intake on the rumen papillae development and function as well as IGF-1 profile *in vivo* and to test the effect of IGF-1 on rumen epithelial cell proliferation *in vitro*. The plasma IGF-1 (RIA), ruminal VFA and weight gain were measured before and weekly during experiment. On d 42 of experiment, the papillae size and ion transport (Ussing-chamber) was determined. The isolated epithelial cells were incubated with (25 ng/ml and 50 ng/ml) or without IGF-1 to measure the cell cycle *in vitro*. The HL treatment significantly increased daily weight gain ($P < .05$) and plasma IGF-1 concentration. Compared with LL treatment, the papillae size and surface of rumen epithelium was larger (717, 476 and 110 vs 1626, 1089 and 242 mm²/cm², $P < .05$) in the atrium, ventral rumen sac and ventral blind sac and, the rumen transport of Na⁺ across the epithelium (ventral rumen) was significantly increased by HL treatment. The total VFA concentration was almost identical, but the mole percentage of ruminal butyric and propionic acid was higher in HL ($P < .05$). *In vitro*, 25 ng/ml of IGF-1 increased S and S+G₂ phase cells in LL ($P < .05$ and $P < .10$) and S phase cell in HL ($P <$

.10) treatment, but 50 ng/ml administration did not. The cell number of S phase ($P < .05$) and S+G₂ phase ($P < .05$) were enhanced in HL by 25 ng/ml of IGF-1. The results *in vivo* show a correlation between concentrate feeding, plasma IGF-1 and rumen papillae development. The *in vitro* results suggest that IGF-1 promotes rumen epithelial cell proliferation and that the response of epithelial cell to IGF-1 was regulated by feeding level. In conclusion, the results support the assumption that the effect of feeding level on rumen papillae development is mediated by IGF-1.

Key Words: Feeding level, IGF-1, Rumen papillae

490 Influence of solar radiation and feeding level on feed and water intake, digestibility, thermo-respiratory response and some blood constituents in sheep. Mostafa Kobeisy^{*1}, Faisal Elhommosi¹, Galal Abdel-Hafiz¹, and Hassanain Badawy^{2, 1} *Animal Prod. Dept., Fac. of Agric., Assiut University, Assiut-Egypt., ²Desert Research Center, Cairo-Egypt.*

This study was carried out to investigate the effect of exposure to the direct solar radiation on both feed and water intakes, digestibility of nutrients, thermo-respiratory response, some blood constituents, thyroid (T3&T4) and cortisol hormone. Six clinically healthy saidi rams over one year old and had an average body weight of 40 kg were used in this study. Animals were subjected to solar radiation from 9.00 to 16.00 h and maintained outdoors all over the days of trial through July. Feed and water intake were recorded. Blood samples were taken for Hb, PCV %, and serum total protein, albumin, globulin, triglycerides, cholesterol, AST, ALT, T3,T4 and cortisol determination. Respiration and rectal temperature were recorded. Digestibility coefficient were determined. The digestibility coefficients of DM, OM, CP, NFE, ADF and ADF were higher ($P < 0.01$) in animals exposed to direct sun rays than those non-exposed. Respiration rate and rectal, skin and wool temperatures revealed higher ($P < 0.01$) values after exposure to direct sun light than that before exposure. Solar radiation decreased ($P < 0.01$) serum glucose, cholesterol and cortisol hormones concentrations. Animals fed ad libitum level of nutrition had higher ($P < 0.01$) PCV,% than those fed restricted level, particularly after sun exposure. Animals exposed to solar radiation had lower concentrations of glucose and cholesterol.

Key Words: Sheep, solar radiation, digestibility, blood, thermo-respiratory response

491 Cortisol, insulin, triiodothyronine and weight gain in Hereford and Senepol steers on endophyte-infected tall fescue or orchardgrass. R. Browning, Jr.*¹, N. Whittingham, and T. Payton, *Tennessee State University, Nashville.*

Heat-sensitive Hereford (278 kg; n = 30; H) and heat-tolerant Senepol (261 kg; n = 28; S) steers were fed endophyte-infected tall fescue (TF) or orchardgrass (OG) to assess the effect of heat tolerance in cattle on physiological responses to endophytic fescue. Following a pretreatment diet of OG hay, 15 H and 14 S steers were fed TF hay and seed, while the remaining 29 steers were fed OG hay and seed. The study was from mid-June to mid-October of 2000 with experimental diets starting in mid-July. Steers were weighed and bled at 2-wk intervals for 4 mo. Cumulative weight gain was similar for the groups during the 1-mo pretreatment period (21, 20, 26, and 25 \pm 3 kg for HOG, HTF, SOG, and STF, respectively). Weight gain was affected ($P < 0.03$) by a breed \times diet interaction after 1 mo of treatment. Weight loss in HTF (-19 \pm 3 kg) differed ($P < 0.01$) from weight maintenance in STF (1 \pm 3 kg), which in turn differed ($P < 0.01$) from weight gain by HOG and SOG (11 and 17 \pm 3 kg, respectively). After 3 mo on the experimental diets, breed \times diet affected ($P < 0.001$) cumulative weight gain with HTF exhibiting lower ($P < 0.01$) total weight gain (28 \pm 3 kg) compared to STF, SOG, and HOG (48, 50, and 56 \pm 3 kg, respectively). Plasma insulin and triiodothyronine concentrations were affected by a breed \times diet \times time interaction ($P < 0.05$). During the first 2 mo of dietary treatment, mean triiodothyronine concentrations were higher ($P < 0.01$) for STF (126 \pm 3 ng/mL) compared to HTF, HOG, and SOG (104, 107, and 107 \pm 3 ng/mL, respectively). During the first month on experimental diets, HTF had lower ($P < 0.001$) insulin concentrations (3.7 \pm 0.3 μ IU/mL) compared to SOG, STF, and HOG (5.4, 6.0, and 6.2 \pm 0.3 μ IU/mL, respectively). Plasma cortisol concentrations

were not affected by a 3-way or diet \times time interaction. Results suggest that heat tolerance in steers can modify physiological responses to endophyte-infected tall fescue.

Key Words: Fescue Toxicosis, Cattle Breeds, Heat Tolerance

492 The effect of supplemental feed at parturition in the rainy season on hair sheep ewe performance in the tropics. R.W. Godfrey*, W. Gonzales, and R.E. Dodson, *University of the Virgin Islands, Agricultural Experiment Station, St. Croix.*

St. Croix White and Barbados Blackbelly hair sheep ewes were used to evaluate the effect of supplemental nutrition around lambing on ewe and lamb performance during the wet season on St. Croix. Beginning 14 d prior to expected day of lambing (day 0) and for 21 d postpartum, 11 ewes were fed a pelleted complete ration (17% crude protein) at a level to provide 150% of the nutrient requirements, in addition to grazing guinea grass pasture (FEED). Twelve ewes grazed pasture only (CONTROL). This study was conducted during October through January. Total rainfall during this time was 212 mm and forage dry matter ranged from .77 to 2.49 MG/ha. The 24-hr milk production of all ewes was measured on days 7, 21, 35, 49 and 63. Ewes were given 1 IU of oxytocin (i.v.) and

milked by hand and separated from their lambs. Four hours later ewes were hand milked again, using oxytocin, and the milk from the second milking was weighed to determine 24-hr milk production. Ewes were exposed to sterile rams equipped with marking harnesses to detect estrus during the postpartum period. Lambs were weaned at 63 d of age. Data were analyzed by SAS using treatment and days postpartum as main effects. The CONTROL ewes lost a higher percentage ($P < .05$) of their pre-lambing weight during lactation than FEED ewes. There was no difference ($P > .10$) in milk production between FEED and CONTROL ewes. The time to first postpartum estrus was less ($P < .03$) in FEED than in CONTROL ewes (33.0 ± 2.5 vs 41.1 ± 2.4 d, respectively). Litter birth weight was similar ($P > .10$) for FEED and CONTROL ewes ($4.2 \pm .5$ vs $4.9 \pm .4$ kg, respectively). Lamb weaning weight was not different ($P > .10$) for lambs raised by FEED or CONTROL ewes ($17.3 \pm .9$ vs $15.8 \pm .8$ kg, respectively). There was no difference ($P > .10$) in ADG of lambs in the FEED or CONTROL groups (222.1 ± 13.6 vs 200.4 ± 11.9 g/d, respectively). Supplementation of hair sheep ewes around parturition during the rainy season in the tropics does not appear to enhance ewe or lamb production traits.

Key Words: Sheep, Lamb, Milk Production

ASAS/ADSA Ruminant Nutrition: Fat Nutrition/Feed Intake

493 Effect of feeding different sources of supplemental fat on the performance of lactating buffaloes. H. Nawaz, M. Abdullah*, and G. Mohiuddin, *University of Agriculture, Faisalabad, PAKISTAN.*

Four early lactating Nili-Ravi buffaloes were fed four experimental diets either containing no added fat (control) or tallow, poultry fat or mustard oil at 3 per cent of diet dry matter in a 4 \times 4 Latin Square Design. The intakes of DM, and CP decreased ($p < 0.05$) in buffaloes fed diet supplemented with tallow or poultry fat compared to either control or diet containing mustard oil. Intake of NEL were significantly higher in buffaloes consuming mustard oil versus those fed the control diet or diets containing tallow or poultry fat (21.4 vs. 19.6 19.0 19.4 Mcal/d, respectively). Average daily production of milk and 4 percent FCM, was significantly higher in buffaloes fed diets containing supplemental fat (13.0, 20.6, kg/d) vs. in those fed the control diet (10.6, 16.0, kg/d), respectively. Milk fat percentage was significantly higher (8.38 %) in buffaloes consuming diet supplemented with tallow than in those fed diet supplemented with poultry fat (7.90 %), mustard oil (7.45 %) or control diet (7.41 %). The concentrations of C8:0 to C16:1 fatty acids were lower (39.16 vs. 59.13 %) while those of C18:0 to C20:0 were higher (59.69 vs. 40.04 %) in milk fat of buffaloes fed diets containing supplemental fat than in those fed the control diet. Total solids contents were higher for buffaloes consuming tallow-supplemented diet (17.75 %) versus those fed the control (16.47 %), poultry fat (17.27 %) or mustard oil (16.56 %) supplemented diets. The GE of milk (Kcal/kg) and total GE of milk (Mcal/d) were higher for buffaloes consuming the tallow-supplemented diet (1221 and 15.7) compared with the control (1063 and 11.2) or diet containing mustard oil 1074 and 13.7). Digestibility of DM was significantly higher in animals fed diet-containing tallow (71.3 %) than in those fed the control diet (69.9 %). The digestion coefficient of EE increased significantly in buffaloes fed diets containing tallow (75.9 %) and poultry fat (73.8 %) versus the control (70.2 %) or the diet containing mustard oil (69.4 %). Significantly lower ratios of acetate to propionate were observed in buffaloes fed different fat sources (2.6) than the control diet (3.18).

Key Words: Supplemental fat, Buffaloes, Milk production, Digestibility

494 Effect of feeding different levels of supplemental tallow on the performance of lactating buffaloes. M. Abdullah*, H. Nawaz, and G. Mohiuddin, *University of Agriculture, Faisalabad, PAKISTAN.*

Four early lactating Nili-Ravi buffaloes were fed four experimental diets containing 0, 2, 4 or 6 % tallow in a 4 \times 4 Latin Square Design. The intakes of DM, OM, CP, ADF and NDF decreased ($p < 0.01$) but intake of EE ($p < 0.01$) and DE ($p < 0.05$) increased with increasing levels of tallow in the diets. Intake of NEL did not differ significantly with varying levels of supplemental tallow. Daily milk yield increased (from 11.0 to

13.2 kg/d, $p < 0.01$), production of 4 percent FCM, SCM, and ECM increased quadratically ($p < 0.05$) with the increasing level of tallow in the diets. Milk fat content and total milk fat increased respectively with increasing levels of tallow. The proportion of C8:0 to C16:1 fatty acids decreased (53.66 to 35.52 %), whereas, concentration of C18:0 to C20:0 increased (44.93 to 62.84 %) in milk fat of buffaloes fed diets containing different levels of tallow. No differences were observed in concentration of milk protein and lactose among control and those fed different levels of tallow. Total solids contents increased (16.45 to 17.67 %, $p < 0.05$) but SNF percentages did not vary with varying levels of tallow. The GE of milk (Kcal/kg) increased (1096 to 1160, $p < 0.01$) with increasing levels of tallow in the diets. Energetic efficiency of milk production improved in a quadratic ($p < 0.05$) manner with 2, 4 and 6 percent tallow, highest (47.6 %) with 4 % supplemental tallow. The digestibility of DM and OM was 66.4 & 63.4, 67.9 & 64.9, 70.6 & 67.2 and 67.4 & 62.7 %, ($p < 0.05$) with 0, 2, 4 and 6 % supplemental tallow in the experimental diets, respectively. The digestibility of CP did not differ, while that of EE improved (68.2 to 74.5 %, $p < 0.01$). The blood pH and concentration of glucose did not vary significantly due to varying levels of tallow in the diets. The concentrations of cholesterol, triglycerides and blood lipids increased ($p < 0.01$) with increasing levels of tallow. A linear ($p < 0.01$) decrease in acetate to propionate ratio was observed with increasing levels of tallow in the diets (3.24 to 2.66, $p < 0.01$).

Key Words: Supplemental tallow, Buffaloes, Milk production, Digestibility

495 A two-year study measuring the reproductive performance of dairy cows fed soybeans. A. Mowrey*, J. N. Spain, M. C. Lucy, M. R. Ellersieck, and K. L. Fritsche, *University of Missouri - Columbia.*

Two studies were conducted during two consecutive years to evaluate the effects of fat supplementation on milk production and reproduction in dairy cows. Year 1 (Y1) utilized a randomized complete block design with 84 early lactation dairy cows fed a control diet or a diet with either raw cracked soybeans or a rumen inert fat product added. In Year 2 (Y2), 68 early lactation dairy cows were fed a control diet or one of three diets containing increasing amounts of soybeans. Cows received treatments beginning two weeks post-calving and were fed assigned treatment until animals were inseminated (Y1) or until 70-d post calving (Y2). Milk yield, milk components, intake, body weight and plasma progesterone were measured. During Y1, pretreatment and experimental milk yield was significantly higher for control and soybean-fed cows ($P \leq 0.05$). Fat-corrected milk yield was not different among diets. Dry matter intake followed the same trend as milk yield, averaging less for cows fed inert fat; as a percent of body weight these changes were not significant. Plasma stearic acid increased following feeding of the diets containing supplemental fat. Progesterone concentrations changed little due to dietary treatments. Ultrasonographic measures of follicular