rapidly. Survival was modeled in three ways: 1) time to death, 2) time to death or treatment for osteoarthritis, or 3) time to death or treatment for any chronic disease. Time-to-first osteoarthritis treatment or death was longer with lower basal glucose and higher insulin sensitivity (P = 0.021, P = 0.023), and median survival time tended to be greater with lower basal glucose and insulin (P = 0.065, P = 0.096), but diet restriction explained most variation. Higher insulinogenic indices associated with greater median survival (P = 0.053) and those with higher insulin sensitivity had less (P = 0.018) hazard of dying or receiving chronic disease treatment. These insulin indices added more information than diet restriction alone (P = 0.057, P = 0.055). Lifelong diet restricted glucose disposal efficiency and insulin response was associated with increased life quality and quantity.

Key Words: Diet restriction, Chronic disease, Dog

Forages & Pastures: Grasslands, forage supplementation

360 Effect of defoliation system and nitrogen input on nitrate losses from grassland systems.

M. Wachendorf*, M. Buechter, H. Trott, and F. Taube, *University of Kiel, Kiel, Germany.*

Nitrogen (N) recovery in specialized dairy farms is known to be low. This causes serious environmental problems due to increased losses of N as nitrate (NO_3) to the watercourse, as in northern central Europe intensive dairy farming is mainly located on freely draining sandy soils. As part of an integrated research project, a field experiment was conducted over a 4 year period to determine NO_3 leaching losses on grassland, which is the predominant forage crop in this region. The experiment consisted of all combinations of five defoliation systems, i.e. cutting-only, rotational grazing, mixed systems with one or two silage cuts plus succeeding rotational grazing respectively, and simulated grazing, four mineral N application rates (0, 100, 200, and 300 kg N ha^{-1} yr^{-1}), and two slurry levels (0 and 20 m# slurry ha^{-1} yr^{-1}). Prior to the start of the experiment, white clover was established in all plots by oversowing. Samples of leachate were taken by ceramic suction cups. Water fluxes were derived from water balance calculations. Due to the high N return by grazing animals leaching losses in rotational grazing systems generally caused NO_3-N concentrations exceeding the European Union (EU) limit for drinking water (50 mg NO_3 l^{-1}). NO_3 leaching losses in a rotational grazing system could be reduced by lowering the N fertilizer intensity and inclusion of one or two silage cuts in spring. However, even in unfertilized mixed systems NO_3 concentrations were well above the EU limit. In terms of leaching losses, the cutting-only system was the most advantageous. NO_3 leaching losses (y; kg N ha^{-1}) could be predicted by the amount of soil mineral N at the end of the growing season (x_m; kg N ha^{-1}) with: y = - 9.5498 + 0.6758 x_m; r^2=0.74; s.e. 11.2 and by the N surplus calculated from N balances at the field scale (x_s; kg N ha^{-1}) with: y = 17.2200 + 0.1907 x_s; r^2=0.77; s.e. 10.4. From the results obtained an adapted N fertilization and a reduced grazing intensity by integrating silage cuts are suggested.

Key Words: Grassland, Nitrogen losses, Environment

361 Metabolic changes in Brangus stocker calves grazing wheat pasture.

L. A. Appeddu*[1], M. A. Brown[2], and W. A. Phillips[2], [1]*Southwestern Oklahoma State University, Weatherford, OK,* [2]*USDA-ARS Grazinglands Research Laboratory, El Reno, OK.*

Previous research suggests stocker calves do not effectively convert wheat forage to gain when first placed on pasture. The objective of this research was to investigate metabolic changes in stockers over the first 21 to 49 d on fall wheat pasture (39% CP, 35% NDF) by evaluating serum metabolites and rumen function in Brangus x Hereford calves. Calves were weaned (n = 24; 268 ± 36.4 kg), and offered Prairie hay *ad libitum* (6% CP, 76% NDF) and 40% CP supplement daily (1362 g hd^{-1}). Calves were sorted into three groups to be placed on wheat at successive 10 to 14 d intervals. Calf weights and serum samples were taken prior to and after grazing wheat. Rumen fluid was taken from two cannulated steers over 72 h on 10 d prior to and 4 d after placed on wheat to determine ammonia levels. Additional fluid was taken to evaluate potential changes in 48-h *in vitro* digestibility of wheat forage prior to and on d 6, 13, and 21 after grazing wheat. As expected, calves did not achieve a positive weight gain until after grazing wheat for 14 d. Calves gained 1.7 kg d^{-1} from d 28 to 49. Serum non-esterified fatty acid levels did not change in steers prior to or after grazing wheat for 6 or 13 d (295 vs avg 294 ± 23.7 mg dl^{-1}); however, levels decreased (P < 0.001) by d 20 and 27 (avg 213 mg dl^{-1}). Serum glucose levels increased (P < 0.01) after d 20 (87 vs 100 ± 5.0 mg dl^{-1}). Serum urea nitrogen was higher (P < 0.001) during the first 21 d on wheat regardless of sample day (9 vs 23 + 0.7 mg dl^{-1}). Rumen ammonia levels also increased (P < 0.001) after cannulated steers were placed on wheat (2.5 vs 22.7 ± 3.74 g dl^{-1}). Serum glucose and urea nitrogen remained elevated through d 49 (117 ± 5.0 and 21 ± 1.2 mg dl^{-1}). Day of rumen fluid collection did not change wheat forage *in vitro* digestibilities (90 ± 1.1%). From January 2 to April 9, 2002, calves gained 1.0 + 0.05 kg d^{-1}, and wheat quality declined to 26% CP, 51% NDF, and 83% *in vitro* digestibility. Serum urea nitrogen and glucose levels remained above 21 ± 0.8 and 83 ± 7.1 mg dl^{-1}. While potential digestibility of wheat forage remains high, results suggest stocker calves adjust metabolically when first introduced to wheat pasture before positive weight gains can be achieved.

Key Words: Wheat pasture, Metabolism, Adaptation

362 Effect of field pea based supplement on intake, digestion, and ruminal fermentation of nursing steer calves grazing native range in western North Dakota.

A. A. Gelvin*[1], G. P. Lardy[1], J. S. Caton[1], and D. G. Landblom[2], [1]*North Dakota State University, Fargo, North Dakota/USA,* [2]*Dickinson Research Extension Center, Dickinson, North Dakota/USA.*

Eight Angus x Hereford nursing steer calves (145 ± 44 kg initial BW) fitted with ruminal cannulas were used to evaluate effects of field pea-based supplement and advancing season on dietary composition, intake, digestion, and ruminal characteristics. Treatments were control (CON) and field pea-based creep (CREEP; 19.1% CP, DM basis) fed at 0.45% BW daily. Calves grazed native pasture with their dams from late June through early November. Collection periods were 10-d long and occurred in July, August, September, and October. Masticate samples from CREEP were lower in ADF ($P = 0.09$) and higher in CP ($P = 0.07$) than CON. Dietary CP and ADIN decreased linearly with advancing season ($P \leq 0.03$). In vitro OM digestibility decreased from July to October ($P < 0.01$; 58.5% to 41.3%). Forage intake was not different ($P = 0.89$) between treatments, but increased linearly with advancing season (1.67, 1.90, 3.12, 3.38 kg/d for July, Aug, Sep and Oct, respectively; $P = 0.03$). Milk intake (% BW) was similar ($P = 0.55$) between CON and CREEP, but decreased linearly ($P = 0.001$) with advancing season. Supplemented calves had greater total intake (forage + milk + creep; $P = 0.05$) than CON. Grazed forage OM and CP digestibilities were higher ($P = 0.004$) for the CREEP than CON. With advancing season, NDF, ADF, and OM digestibilities decreased linearly ($P < 0.01$). No treatment effects were observed for in situ DM disappearance rate of forage or creep ($P > 0.10$). Creep DM disappearance decreased linearly ($P = 0.02$) and forage DM disappearance decreased quadratically ($P = 0.03$) with advancing season. Supplementation reduced ($P < 0.01$) ruminal pH at several times measured. Ruminal ammonia levels were higher ($P < 0.01$) in CREEP compared with CON. These data indicate supplementation with field peas increases total intake but has no effect on forage or milk consumption of nursing calves.

Key Words: Calves, Intake, Digestion

363 Reproductive responses and carcass characteristics of ram lambs fed endophyte-infected tall fescue.

J. M. Burke*[1], C. F. Rosenkrans[2], R. W. Rorie[2], C. Golden[2], and J. K. Apple[2], [1]*USDA, Agricultural Research Service, Dale Bumpers Small Farms Research Center,* [2]*University of Arkansas, Department of Animal Science.*

The objective of this study was to examine the influence of endophyte-infected tall fescue on reproductive development and function and carcass characteristics of ram lambs. Hampshire and Suffolk rams, 214 d of age, were fed individually a diet of endophyte-free (EF; n = 8) or infected (EI; n = 9) fescue seed (34% of diet; 4.8 μg/g ergovaline) for six weeks. Intake was similar between treatments and averaged 2.7% BW (33.7 μg ergovaline/kg BW). Daily high temperature ranged between 16 and 27°C. Data were analyzed using the mixed models, repeated measures procedure of SAS and heterogeneity of regression. Signs of fescue toxicosis in EI fed rams included increased rectal temperature

(treatment × day, $P < 0.001$, $R^2 = 0.11$), increased respiration rate at higher ambient temperatures (treatment × day, $P < 0.003$, $R^2 = 0.07$), and reduced serum concentrations of prolactin (treatment × day, $P < 0.001$). Body weight of EI fed rams tended to decrease after 36 d of feeding (-3.0 vs 0.51 kg; $P < 0.07$); BCS was similar between treatments throughout the trial. Serum concentrations of testosterone were greater in EI compared with EF fed rams (treatment × day, $P < 0.005$, $R^2 = 0.08$). Spermatozoa concentration tended to be greater in EF compared with EI fed rams after 43 days of feeding ($P < 0.07$). Rate of forward movement of spermatozoa tended to be greater in EF compared with EI fed rams between Days 15 and 29 of feeding (treatment × day, $P < 0.08$). Scrotal skin temperature, scrotal circumference, semen volume, percent sperm motility, and percent abnormal sperm were similar between treatments. Weights of reproductive and vital organs, carcass cutability and quality characteristics were similar between EF and EI fed rams. Feeding of EI fescue seed to ram lambs led to decreased concentrations of spermatozoa in semen and increased serum concentrations of testosterone, perhaps due to decreased steroid clearance rate.

Key Words: Rams, Reproduction, Tall Fescue

364 Comparison of urea and soybean meal as nitrogen supplements to cool-season, low-quality forage: I. Daily and alternate day supplementation effects on digestion and ruminal fermentation in steers.

D. W. Bohnert*[1], C. S. Schauer[1], S. J. Falck[1], and D. L. Harmon[2], [1]*Eastern Oregon Agriculture Research Center, Burns,* [2]*University of Kentucky, Lexington.*

Five steers (464 ± 26 kg BW) were used in an incomplete 5 × 4 Latin square with four 18-d periods to determine the influence of supplemental N source and supplementation frequency (SF) on nutrient intake and digestion in steers offered hard fescue straw (4.7% CP; 78% NDF). Treatments (TRT) included an unsupplemented control (CON) and a urea or soybean meal (SBM) supplement placed directly into the rumen daily (D) or every-other-day (2D) at 0700. Urea supplements were provided to meet 100% of the degradable intake protein requirement while SBM supplements were provided on an isonitrogenous basis. The D TRT were supplemented CP at 0.04% of BW/day while the 2D TRT were supplemented at 0.08% of BW every-other-day. Therefore, all supplemented TRT received the same quantity of supplemental CP over a 2-d period. Straw was provided at 120% of the previous 5 d average intake in two equal portions at 0730 and 1900. Ruminal fluid was collected 0, 3, 6, 9, 12, and 24 h post-supplementation on a day all supplements and a day only daily supplements were provided. Straw and total DMI increased ($P < 0.03$) with CP supplementation; however, DM and OM digestibility was not influenced ($P > 0.19$) by CP supplementation or SF. Ruminal indigestible ADF passage rate and NH_3N increased ($P < 0.04$) with supplemental CP on the day all supplements and the day only daily supplements were provided. However, CP source × SF interactions ($P < 0.05$) indicate that, as urea SF decreased, ruminal NH_3N increased on the day all supplements were provided and decreased on the day only daily supplements were provided with little change noted as SF of SBM decreased. These results suggest that urea or SBM can be used effectively as supplemental N sources by steers consuming low-quality forage without adversely affecting DMI and DM digestibility, even when provided every-other-day.

Key Words: Protein, Supplementation, Forage

365 Comparison of urea and soybean meal as nitrogen supplements to cool-season, low-quality forage: II. Daily and alternate day supplementation effects on efficiency of nitrogen use in lambs.

D. W. Bohnert[1], S. J. Falck*[1], and C. S. Schauer[1], [1]*Eastern Oregon Agriculture Research Center, Burns.*

Five wethers (52 ± 2 kg BW) were used in an incomplete 5 × 4 Latin square with four 18-d periods to determine the influence of supplemental N source and supplementation frequency (SF) on efficiency of N use in lambs offered hard fescue straw (4.7% CP; 77% NDF). Treatments (TRT) included an unsupplemented control (CON) and a urea (29% CP) or soybean meal (SBM; 26% CP) supplement provided daily (D) or every-other-day (2D) at 0700. The D TRT were supplemented CP at 0.10% of BW/day while the 2D TRT were supplemented at 0.20% of BW every-other-day. Therefore, all supplemented TRT received the same quantity of supplemental CP over a 2-d period. Lambs were provided straw at 120% of the previous 5 d average intake in two equal portions at 0730 and 1900. Experimental periods were 18 d with feces and urine collected on d 13 to 18. Blood samples were obtained 4 h post-supplementation on d 13 to 18 for analysis of plasma urea-N (PUN). Dry matter intake, OM intake, N intake, N retention, DM, OM, and N digestibility, and digested N retained were greater ($P < 0.01$) for supplemented wethers compared with CON with no differences ($P > 0.05$) because of N source or SF. There were no differences in fecal or urinary N excretion because of N supplementation or SF ($P > 0.10$). However, PUN was increased ($P < 0.01$) in supplemented lambs compared with CON (5.8 compared with 3.7 mM) and urea TRT had greater ($P < 0.01$) PUN compared with SBM. Also, PUN was increased ($P = 0.05$) for D compared with 2D TRT. These results suggest that supplements containing urea or SBM as the supplemental N source can be effectively used by lambs consuming cool-season, low-quality forage without adversely affecting N efficiency, even when provided every-other-day. However, SBM should have greater utility for use in supplements offered infrequently to ruminants because it is comparatively nontoxic compared with urea.

Key Words: Protein, Frequency, Supplementation

366 Animal performance and forage quality effects on steers intensively grazing summer perennials.

A. M. Bowers*, M. E. Boyd, and D. J. Lang, *Mississippi State University.*

A study to compare the performance of four forage systems Sumrall 007 bermudagrass (*Cynodon dactylon*) (S007), Tifton 44 bermudagrass (*Cynodon dactylon*) (T44), common bermudagrass (*Cynodon dactylon*)/dallisgrass (*Paspalum dilatatum*) (CD) and Alamo switchgrass (*Panicum virgatum*) (AS) in a summer stocker system was conducted from 2000-2002 at the Leveck Animal Research Center, Starkville, MS. Steers were intensively grazed with stocking rates varying by year, forage and forage availability. Forage systems were replicated three times. Pastures were 1.6 ha in size and were divided into 10 paddocks with electric fence. Fertilization was identical for all pastures and at a level suitable for the hybrid bermudagrasses. Animal and forage system performance measures were initial stocking rate, periodic (28 d) and overall average daily gain, and periodic and cumulative gain per ha. Forage samples, collected monthly from each pasture, were analyzed for DM, IVDMD, IVDMD followed by a NDF wash, NDF, and ADF. A mixed model analysis was used to analyze both the animal and forage data. Bermudagrass systems were analyzed against each other for three years. AS was included in only the last two years due to slow initial development. Stocking rate, kg/ha, was consistently greater ($P<0.05$) across all periods for the S007 and T44 than for the CD or AS, 2812.3 and 2851.6 vs. 2182 .6 and 2073.8 respectively. All other animal measurements were not significant. Cumulative ADG, kg/d, for each forage were 1.6 (CD), 1.5 (S007), 1.46 (AS), and 1.41 (T44). Forage analysis is only available for the first two years. IVDMD ($p=0.009$) was significant for period, greater for May (53.73) than June (49.40) and July (45.54) or August (45.79) and greater for CD (51.95) and S007 (49.19) than for T44 (44.72). CD (66.46) were significantly greater than S007 (60.97) and T44 (58.93) for IVDMD/NDF. NDF (64.65) and ADF (30.21) were significant for period with May less than all other months.

Key Words: Stocker steers, Intensive grazing, Summer perennials

367 Effect of protein supplementation of warm versus cool season forages on intake, digestibility, and ruminal fill in beef steers.

G. D. Pulsipehr*, D. W. Bohnert, T. DelCurto, K. J. Walburger, M. S. Wells, and J. J. White, *Eastern Oregon Agriculture Research Center, Union, OR.*

Sixteen ruminally cannulated steers (BW 243 ± 4 kg) were used to evaluate the effects of warm vs cool season forages with or without protein supplementation on intake, digestibility, and ruminal fill in a completely random design. Treatments were arranged in a 2 x 2 factorial. Factors were; 1) forage type, warm season (**WS**, 6.3% CP 68% NDF) or cool season (**CS**, 6.3% CP 67% NDF), and 2) protein supplementation, no supplement (**NC**) or 0.45 kg/d of a 34% CP supplement (**S**). The trial was 28 d in length. Intake was determined on d 17 to 21, total fecal collections were conducted on d 18 to 22, and in situ digestibility was determined on d 23 to 24. Total ruminal evacuations were conducted four h after feeding on d 28. There was an interaction ($P = 0.01$) in BW change with CSNC and CSS steers having similar BW change (1.0 vs 0.0 kg respectively) while WSNC steers lost more weight than WSS steers

(-19.2 vs #2.5 kg respectively). Forage and total DM intake was greater ($P = 0.03$) in steers fed CS forage than WS forage and was greater ($P = 0.01$) in S steers than NC. Total tract DM digestibility was greater ($P < 0.01$) in steers fed CS forage than in steers fed WS forage. There were no differences ($P > 0.34$) in ruminal DM fill or volume. An interaction ($P < 0.03$) between forage type and supplementation occurred for *in situ* lag time and rate of digestion. With CS forage, protein supplementation decreased lag time and rate of digestion, but with WS forage, protein supplementation increased lag time and rate of digestion. An interaction ($P = 0.06$) also occurred for in situ 48 h extent of digestion. Cool season S and CSNC had similar extent of digestion (50.0 vs 50.6% respectively), while WSNC steers had a lower extent of digestion than WSS steers (38.6 vs 43.6% respectively). Results indicate WS forage decreases intake and digestibility compared to CS, and protein supplementation is a greater benefit with WS forage.

Key Words: Warm season forage, Cool season forage, Protein supplementation

368 Effect of backgrounding growth rate and forage or concentrate finishing on beef quality. C. E. Realini*[1], S. K. Duckett[1], J.P.S. Neel[2], J. Fontenot[3], and W. R. Clapham[2], [1]*The University of Georgia, Athens,* [2]*USDA-ARS Beaver, WV,* [3]*Virginia Tech University, Blacksburg.*

Meat quality was evaluated from 72 Angus cross steers finished on forage (FOR) or concentrate (CONC), after being backgrounded at low (LOW, ADG=0.36 kg), medium (MED, ADG=0.55), or high (HIGH, ADG=0.82) growth rates. Steers were harvested at a commercial meat plant, the rib (IMPS107) removed and transported to the UGA. The 9-10-11 rib section was dissected into lean, fat and bone. Data were analyzed as a 3 x 2 factorial design with backgrounding treatment, finishing treatment, and two-way interaction in the model. Total rib weight tended to be greater ($P < 0.10$) for HIGH than LOW backgrounding treatments, and greater ($P < 0.01$) for CONC than FOR finishing treatments. Percent lean was greater and percent fat lower for MED than LOW. Ribs from FOR had greater ($P < 0.01$) bone and lean percent, and lower ($P < 0.01$) fat percent than ribs from CONC. Backgrounding growth rate had no effect ($P > 0.05$) on longissimus or subcutaneous fat color (L* lightness, a* redness, and b* yellowness). Longissimus color of CONC was lighter ($P < 0.01$, higher L*) and redder ($P < 0.01$, higher a*) than FOR with no differences in yellowness. Subcutaneous fat color of FOR was darker ($P < 0.01$) and more yellow ($P < 0.01$) than CONC. Backgrounding did not alter ($P > 0.05$) shear force of longissimus steaks. Warner-Bratzler shear force was higher ($P < 0.05$) for CONC than FOR at 14 d postmortem; but did not differ ($P > 0.05$) at 28 d. Increased growth rate during backgrounding period (MED and HIGH) reduced ($P < 0.05$) sensory tenderness scores for CONC but not for FOR. Juiciness was higher ($P < 0.01$) for FOR than CONC when animals were backgrounded on HIGH, with no differences at LOW or MED growth rates. Panelists assigned higher ($P < 0.05$) beef flavor and lower ($P < 0.01$) off flavor scores to CONC compared to FOR. Increased growth rate during backgrounding period increased rib weight and altered composition. Finishing cattle on CONC resulted in greater rib weight and percent fat, and lower percent of lean and bone than FOR. Forage finishing reduced longissimus shear force at 14 d and increased sensory tenderness scores for higher backgrounding growth rates.

Key Words: Forage, Concentrate, Backgrounding

369 Effect of feed intake level and forage source on kinetics of fiber digestion in situ and nutrient digestibility in beef cattle. S. A. Bhatti[1], J. G. P. Bowman[1], A. V. Grove*[1], and C. W. Hunt[2], [1]*Montana State University,* [2]*University of Idaho.*

Four ruminally cannulated steers were used in a 4 × 4 Latin square design study with a 2 × 2 factorial arrangement of treatments to evaluate the effects of feed intake level and forage source on fiber digestion and nutrient digestibility. Treatments were: 1) ad libitum orchardgrass hay, 2) restricted feeding of orchardgrass hay, 3) ad libitum orchardgrass plus alfalfa in a ratio of 3:1, and 4) restricted orchardgrass plus alfalfa in ratio of 3:1. Dry matter intake was lowest ($P \leq 0.05$) for steers fed restricted diets (1.0% BW), intermediate for steers fed orchardgrass ad libitum (1.6% BW), and highest for steers fed orchardgrass plus alfalfa ad libitum (2.0% BW). Intake level and forage source had no effect ($P \geq 0.10$) on total tract nutrient digestibility, lag time of NDF disappearance, or CM-Case activity. Rate of NDF disappearance of orchardgrass was greater ($P \leq 0.06$) when incubated in animals consuming restricted diets versus ad libitum diets, and when incubated in orchardgrass plus alfalfa diets versus orchardgrass only diets. Extent of in situ NDF disappearance of orchardgrass did not differ ($P \geq 0.10$) between intake levels (56.1%), but was lower ($P \leq 0.01$) when incubated in animals consuming orchardgrass plus alfalfa compared to orchardgrass only (57.6 vs 54.4%). Mean retention times of large and small particles of orchardgrass were shorter ($P \leq 0.06$) when steers consumed ad libitum versus restricted diets. Mean retention time of small orchardgrass and small alfalfa particles tended ($P \leq 0.12$) to be shorter when orchardgrass plus alfalfa was fed compared to orchardgrass only. Small orchardgrass particles had a faster ($P \leq 0.09$) rate of passage under ad libitum versus restricted feeding conditions, and when alfalfa was fed with orchardgrass versus orchardgrass only. Rate of passage of large orchardgrass particles, and large and small alfalfa particles did not differ ($P \geq 0.10$) between intake level or forage source. Ad libitum intake resulted in shorter mean retention times of large and small orchardgrass particles and a faster passage rate of small orchardgrass particles. Alfalfa substitution resulted in a faster fiber digestion rate and passage rate of small orchardgrass particles.

Key Words: Particle size, Digestion rate, Passage rate

370 Milk production of dairy cows fed total mixed rations after a grazing period with or without supplementation. F. Bargo*, J. E. Delahoy, and L. D. Muller, *The Pennsylvania State University.*

Twenty multiparous Holstein cows (DIM = 101, BW = 631 kg, BCS = 2.65) were used in a completed randomized design with repeated measures to evaluate milk production when cows were switched to a TMR after a 6-wk grazing period. Starting in May, cows grazed in one group an orchardgrass/bromegrass pasture. Cows were assigned to two treatments: 1) unsupplemented (U): 1 kg/d mineral mix, and 2) concentrate supplemented (CS): 1 kg corn-based concentrate/4 kg milk. Total DMI was higher (26.5 vs. 22.0 kg/d, $P < 0.05$) but pasture DMI (estimated by Cr_2O_3) was lower (16.8 vs. 21.2 kg/d, $P < 0.05$) for CS cows because of the substitution rate of 0.49 kg pasture/kg concentrate. Overall, CS cows had higher 3.5% FCM (32.9 vs. 26.5 kg/d), and lower milk urea N (**MUN**, 9.6 vs. 14.7 mg/dl) and milk fat (3.13 vs. 3.88%) than U cows ($P < 0.05$). Milk response to supplementation averaged 1.08 kg milk/kg concentrate. Cows of both treatments lost BW (- 17 kg/d) and BCS (-0.33, $P < 0.05$). At the end of the 6-wk grazing period, all cows were abruptly switched to a TMR fed in confinement for 11 wk. Overall, DMI (24.3 kg/d), 3.5% FCM (30.6 kg/d), milk fat (3.26%), milk true protein (2.87%), and MUN (12.7 mg/dl) did not differ between the U and CS treatments ($P > 0.05$). Cows gained BW (53 kg) and BCS (0.33, $P < 0.05$). For the U cows, 3.5% FCM and milk true protein increased 3.7 kg/d and 0.45 % units, respectively, and milk fat decreased 0.5 % units ($P < 0.05$). For the CS cows, 3.5% FCM decreased 2 kg/d and milk true protein increased 0.21 % units ($P < 0.05$). A significant treatment by period by day interaction was found for milk yield ($P < 0.05$). The first day in confinement, milk yield was higher (30.9 vs. 19.3 kg/d, $P < 0.05$) for CS. After 10 days, milk yield between treatments did not differ (35.4 kg/d, $P > 0.05$). When cows were switched from only pasture to a TMR, milk yield was comparable to CS cows after 10 days.

Key Words: Pasture, TMR, Milk production

371 Effect of forage diversity on intake and productivity of grazing lactating dairy cows. K. J. Soder*[1], M. A. Sanderson[1], L. D. Muller[2], and J. L. Stack[2], [1]*USDA-ARS Pasture Systems and Watershed Mgmt. Research Unit, University Park, PA,* [2]*The Pennsylvania State University, University Park, PA.*

A study was designed to determine the effects of forage diversity on intake and productivity of grazing lactating dairy cows. Sixteen lactating Holstein cows (100 DIM, 634 kg BW, 4 ruminally cannulated) were assigned to four 4x4 Latin squares with 21-d periods. The four pasture treatments were: (2SP) Orchardgrass/white clover; (3SP) 2SP + chicory; (6SP) 3SP + tall fescue, perennial ryegrass, and birdsfoot trefoil; and (9SP) 6SP + red clover, alfalfa, and bluegrass. Pasture allowance was 25 kg DM/cow/d. Cows were fed a 13% CP corn-based concentrate (1 kg/4 kg milk) in two equal feedings after milking. Pasture DMI was measured using Cr_2O_3 as a fecal marker. Pasture CP

was highest for the 3SP mix. The 2SP mix had the highest NDF and lowest IVDMD. DMI, milk yield, milk fat and protein, and rumen NH_3-N were not affected by treatment. Milk urea N increased on the most complex mix (9SP). Rumen pH and VFA tended to be higher for the 2SP mix. Acetate:propionate decreased with increasing level of pasture diversity. Level of forage diversity did not have a major impact on DMI or productivity of grazing dairy cows. However, forage production and carrying capacity were greater on the complex mixtures than on the 2SP mix.

	2SP	3SP	6SP	9SP	SEM	P
Pasture CP, % DM	21.8	22.1	20.3	19.0	0.46	0.002
Pasture NDF, % DM	36.6	31.7	29.2	24.7	1.57	<0.001
Pasture IVDMD, % DM	66.6	70.4	67.2	70.9	1.20	0.02
Total DMI, kg/d	23.9	22.9	22.8	22.0	0.53	0.13
Pasture DMI, kg/d	14.7	13.7	13.6	12.8	0.46	0.08
Milk, kg/d	35.4	36.3	35.2	35.3	0.31	0.10
Milk Fat, %	3.55	3.38	3.44	3.46	0.07	0.41
Milk Protein, %	2.73	2.72	2.74	2.72	0.02	0.95
MUN, mg/dl	12.9	11.8	12.7	13.3	0.27	0.03
Rumen pH	5.84	5.68	5.64	5.76	0.06	0.11
VFA, mmol/mL	156.4	140.8	144.0	145.6	4.45	0.09
Acetate:Propionate	2.93	2.83	2.68	2.65	0.02	<0.001
NH_3-N, mg/dl	17.4	14.9	16.1	15.4	0.87	0.20

Key Words: Pasture, Dairy, Forage diversity

Growth & Development: Somatotropic axis and adipose development

372 Preadipocyte recruitment is enhanced by ciglitazone or troglitazone in subcutaneous adipose stromal-vascular (S-V) cell cultures, but not intramuscular S-V cell cultures.

S. Poulos* and G. Hausman, *Univ. of GA and USDA-ARS*.

Intramuscular adiposity enhances marketability of meat products. Our understanding of intramuscular adipocyte development is limited. Though studies have shown marbling fat can be modified, intramuscular S-V cultures show these cells do not respond to dexamethasone as do subcutaneous cells. The aim of this study was to determine the adipogenic potential of porcine S-V cells from subcutaneous adipose tissue (SQ) and semitendinosus muscles (STM) using the insulin sensitizing agents, ciglitazone or troglitazone. SQ and both STM from 5-7 day old pigs were asceptically removed and S-V cells obtained from each tissue following a standard collagenase digestion. STM S-V cells were plated on laminin coated culture dishes to maintain a myotube-rich environment. S-V cells from each tissue were plated in media containing fetal bovine serum and 0.01%DMSO supplemented with 0, 10, 25, 50 μM ciglitazone or troglitazone. Upon confluency, cells were switched to insulin containing media for 3 days. Immunohistological evaluation for AD3, a preadipocyte antibody, was used to assess preadipocyte recruitment. Differences between treatments were determined using least square contrasts and $p<0.05$ was considered significant. AD3 cell number per microscopic field was increased in SQ cultures as compared to STM cultures (24.1 16.4 vs 9.8 5.5; $p<0.0001$) regardless of treatment. A dose response curve reveals 10μM ciglitazone or troglitazone treatment increases AD3 cell number per field in SQ S-V cultures (15.3 7.8, DMSO control; 30.5 7.8, ciglitazone, 38.9 7.8, troglitazone; $p<0.05$) though increasing doses in either treatment did not increase AD3 cell number. This is in contrast to STM S-V cultures which did not show an increase in AD3 number at 10, 25, or 50 μM ciglitazone or troglitazone treatment ($p>0.05$). Myotube formation in STM S-V cultures was maintained regardless of treatment. These results suggest intramuscular adipogenesis regulation may be different than that of adipogenesis in subcutaneous adipose. This information is key to the use of STM S-V cultures as cell model systems for marbling fat.

Key Words: Adipose, Porcine, Intramuscular

373 Investigation of the molecular mechanism underlying the anti-adipogenic action of retinoic acid in cultured pig preadipocytes.

T. D. Brandebourg* and C. Y. Hu, *Oregon State University, Corvallis, OR / USA*.

Retinoic acid (RA), the active metabolite of vitamin A, inhibits adipocyte differentiation in vitro. However the mechanism by which RA exerts this effect is poorly understood. The objective of this study was to investigate the molecular mechanism underlying the anti-adipogenic action of RA in cultured pig preadipocytes. In order to determine which member of the RA receptor superfamily mediates this action, porcine stromal-vascular cells were cultured in induction medium (DME/F12 medium containing 100 nM insulin, 10 ng/ml transferrin and 500 ng/ml hydrocortisone) and treated with either carrier (DMSO) or increasing amounts (10 nM to 25 μM) of individual retinoid ligands. On day 8 of culture, glycerol-3-phosphate dehydrogenase activity (GPDH) was measured as a late marker of preadipocyte differentiation. Addition of either RA or 9-cis retinoic acid (9c-RA) to the medium reduced GPDH activity ($P<.001$). However, 9c-RA was less potent requiring a higher dose in order to exert an effect. Addition of TTNPB, a RAR-selective ligand, potently inhibited GPDH activity ($P<.001$). In contrast, methoprene acid, a RXR-selective ligand, significantly increased GPDH activity ($P<.001$). Next, increasing amounts (10 nM to 25 μM) of Ro61, a potent RAR-selective antagonist, were added in the presence of 10 nM TTNPB. Ro61 significantly blunted the ability of TTNPB to inhibit differentiation at all concentrations tested ($P<.0002$). These data taken together indicate that the RAR receptor mediates the anti-adipogenic action of RA in pig preadipocytes. We next investigated whether RA action is dependent upon MAP kinase activity by testing the ability of 10 nM TTNPB to inhibit differentiation in the presence of either 10 μM or 25 μM of PD98059 (MAP kinase inhibitor). PD98059 failed to blunt the anti-adipogenic action of TTNPB at either concentration. These results indicate that the anti-adipogenic action of RA is mediated by the RAR receptor and is independent of the MAP kinase pathway in cultured pig preadipocytes.

Key Words: Retinoic acid, Adipocyte differentiation, Pig

374 Effects of Ralgro implantation to gestating sows on sow and piglet performance and components of the somatotrophic axis.

T. A. Strauch*, J. A. Carroll, E. L. Berg, and B. E. Salfen, *Animal Physiology Research Unit, ARS-USDA, Columbia, MO*.

Objectives were to determine effects of an estrogenic compound (Ralgro; R) on maternal and neonatal piglet performance and components of the somatotrophic axis. On d 60 of gestation, sows were divided into two groups: R (n=7) and control (C; n=4). Treated sows were administered 36 mg R subcutaneously in the ear, and C sows were administered a sham implant. Sow blood samples were collected on d 60 and 80 of gestation and at parturition. Piglet blood samples and BW were collected within 12 hrs of birth. Thereafter, piglet BW were collected on d 7 and 14 of age. Serum was collected from blood samples and stored at -80C until analyzed for serum concentrations of IGF-I, IGF-II, and growth hormone (GH). Data were analyzed using ANOVA with treatment and pig sex as main effects. There were no differences ($P > 0.38$) in serum concentrations of IGF-I or GH between C and R sows; however, there was a trend ($P < 0.10$) for increased serum concentrations of IGF-II in R sows from d 60 of gestation to parturition. There was no difference in litter size ($P < 0.14$), number born alive ($P < 0.33$), or piglet survival to weaning ($P < 0.21$); however, there was a trend ($P < 0.11$) for greater total litter weight in C sows (19.4 $\pm$ 2.3 vs 15.4 $\pm$ 1.2 kg; C vs R). There was no difference ($P > 0.47$) in piglet BW at birth (1.4 $\pm$ 0.04 kg), but there was a treatment effect ($P < 0.002$) on ADG to 7 d of age, with increased ADG in R pigs (0.19 $\pm$ 0.01 vs 0.16 $\pm$ 0.01 kg/d; R vs C). There was a tendency ($P < 0.07$) for increased ADG in R pigs to 14 d of age (0.254 $\pm$ 0.01 vs 0.231 $\pm$ 0.01 kg/d; R vs C). Treatment affected piglet serum concentrations of IGF-I ($P < 0.006$; 52.8 $\pm$ 3.7 vs 38.4 $\pm$ 3.8 ng/mL; R vs C) and IGF-II ($P < 0.0004$; 83.2 $\pm$ 1.5 vs 74.6 $\pm$ 1.8