horse owners, breeders, agribusiness, government agencies and the general public. Agricultural/equine press usage of articles from the web site indicates the value of these materials and its easy and rapid access.

Key Words: Horse, Internet, Extension Programs

557 Holey Cow—The inside story of why cows eat grass—a model for youth agricultural education. D. J. R. Cherney*, B. Berggren-Thomas, and A. W. Bell, *Cornell University, Ithaca, NY.*

Less than 2% of the U.S. population is currently involved in agriculture and many young people have little or no experience with farm animals. We need young people to continue to chose agricultural careers, but also, as adult consumers, to make intelligent choices and policies about issues involving the use of animals for food and fiber. We have developed a program that begins with a PowerPoint slide show describing ruminant animals. The Powerpoint includes images of a variety of ruminant animals that the students may have seen on television or in zoos. We describe how a ruminant is able to use grass with the aid of slides and other props. The presentation is geared to the level and experience of the youth group. These groups range in age from 6 to 18 years and from no animal experience to farm youth. Because these audiences learn best from hands-on experiences, they are invited to handle a rumen-fistulated cow, offer her feed, and explore the rumen. The youth are given lab coats and gloves and can place their arm inside the cow. The program includes the use of a microscope for viewing rumen microflora and a feed demonstration. In this way, participants can see, feel and smell what we have talked about, reinforcing their learning experience. When appropriate, the program also includes discussion of possible careers in animal biology and production. Last year 10 demonstrations were conducted for approximately 350 young people and their chaperones. The program has Institutional Animal Care and Use Committee Approval. Many of the groups bring new students each year. The cow is a critical component of the success of this program.

Key Words: Agricultural Education, Youth

558 *Healthy farms–healthy agriculture*: A new approach to biosecurity education. J. M. Smith*, *University of Vermont, Burlington.*

The University of Vermont entered into a special cooperative agreement with the United States Department of Agricultures Animal and Plant Health Inspection Service in 2002 to distribute biosecurity materials relevant to ruminant livestock production. The original objectives were to develop, produce, and distribute information on (1) biosecurity measures that all personnel, salespeople, consultants, and visitors should follow when entering farm animal premises and (2) measures to follow when bringing animals, especially those of unknown origins, onto existing farms. These objectives were modified during the planning process involving various stakeholders. The stakeholders helped identify our target audiences and the types of information they needed. We concluded that farm owners are responsible for the biosecurity measures practiced on their farms by themselves and their employees, as well as by the agri-service personnel, salespeople, and others who enter the premises. So the materials were designed to be distributed to and used by farmers. In addition to biosecurity procedures for people and new or returning animals, we decided to cover measures to reduce the biosecurity risks posed by wildlife. The title was chosen so as to not be alarming. The main outputs of the project were a professionally-printed, 3-ring binder with about 100 pages of information, a compact disk of the same information adhered inside the back cover, and a web site (www.uvm.edu/∼ascibios/) where the information was posted. Tabbed dividers were labeled introduction, assessment, new animals, visitors, wildlife, biosecure practices, diseases, and appendix. Our goal was a well-organized collection of existing information, reformatted to make it easy for farmers to understand and apply. Sixteen reviewers, who included veterinarians, extension faculty, agri-service personnel, and farmers, made comments on drafts of the materials. The finished binder was distributed to all ruminant and dairy farms listed with the Vermont Agency of Agriculture, Food, and Markets in fall of 2003. A video was also planned but not completed by the end of the one-year project period.

Key Words: Biosecurity, Extension

559 An environmental assessment tool for poultry farms developed as part of environmental management systems. P. H. Patterson*[1], L. E. Lanyon[2], and A. H. Mende[3], [1]*Department of Poultry Science, The Pennsylvania State University, University Park,* [2]*Department of Crop and Soil Sciences, The Pennsylvania State University, University Park,* [3]*PennAg Industies Association, Harrisburg, PA.*

Environmental Management Systems (EMS) for the poultry industry address environmental policy with continuous improvement to ultimately achieve regulatory compliance and pollution prevention. As part of the 9-state Partnership for Livestock Environmental Management Systems project, a team of industry, government and university stakeholders developed an assessment tool for the commercial layer, broiler and turkey industries in Pennsylvania (PA). The goal of the tool was to set environmental priorities, to evaluate environmental protection measures, and to communicate and monitor environmental performance. It was adapted from national and existing PA Farm*A*Syst materials, and field-tested on 10 layer, 10 broiler and 10 turkey farms. Eleven priority areas were evaluated for risk on a scale from 1-low to 4-high risk including: drinking water supply, septic design and operation, run-off issues, mortality management, farm nutrient balance, emergency action planning and more. Example average scores for drinking water supply were: 1.7 layers, 1.7 broilers, 1.4 turkeys, however, the range of scores were 1-2.3, 1-4 and 1-4, respectively, indicating improvement opportunities. Other opportunities were identified for pest, odor and dust management (broilers), mortality management (turkeys) and farm nutrient balance (layers). Survey responses by producers indicated the tool was helpful to their operation, the experience raised awareness, 75% preferred the 3rd party assessment to self-assessment, and 1/3 were interested in pursuing an EMS. An important lesson from the pilot was that producers have little time and a concise, timely assessment was essential. The tool was effective in documenting performance and identifying opportunities. It has been proposed for adoption as the poultry component of PEACCE, a state-wide certificate program for environmental excellence and stewardship in animal agriculture.

Key Words: Poultry, Environmental Assessment, EMS

Forages and Pastures: Harvesting and Grazing Management of Forages

560 The effects of total non-structural carbohydrates (TNC) on voluntary intake of goats and digestibility of gamagrass (GG) harvested in the morning (AM) or afternoon (PM). A. Sauve*[1], G. Huntington[1], and J. Burns[1,2], [1]*North Carolina State University, Raleigh,* [2]*USDA, ARS.*

The objective was to evaluate the differences in TNC of Iuka GG (*Tripsacum dactyloides L.*) harvested at 0530 (AM) or 1730 (PM), and to measure how TNC concentration and CP supplement affect the voluntary DMI and digestible DMI (DDMI) of GG field-cured and stored in square bales. Boer X Spanish wethers (24 ± 3 kg) were randomly assigned to supplement (SP, 31% CP, fed at 11% of DMI, 14 goats) or no supplement (14 goats). Within SP or no SP, goats were randomly assigned to a crossover design of AM GG (7 goats) or PM GG (7 goats). Goats were individually housed in metabolism crates with free access to water and mineral blocks. They were fed twice daily, with SP being offered once a day 30 min before morning feedings. After a 7-d adaptation, voluntary intake (goats were fed 110% of previous days intake) was measured for 14 d, followed by a 4-d adjustment (to equalize DM offered between periods) and a 5-d digestion trial to measure DM digestibility (DMD). After Period 1 the goats were switched to their new diets, and the protocol was repeated. GG concentrations are g/kg DM and intakes are g/d. Means differ at $P < 0.03$. Compared to AM, the PM harvest had greater TNC (72.5 vs. 59.1), monosaccharides (37.3 vs. 27.5),and di- and polysaccharides (15.4 vs. 13.3). The DMD was greater for PM vs. AM (56.0 vs. 53.6%) and for SP vs no SP (57.0 vs. 52.7%). Crude protein (92) and starch (19.1) were similar ($P = 0.98$) for PM and AM. Compared to no SP, SP increased total DDMI(DMI times DMD from the digestion trial)during the voluntary intake phase(344 vs. 305) and digestion trial (337 vs. 292). However, GG DMI was not affected ($P > 0.17$) by SP during the voluntary intake phase(531 vs. 571) or digestion trial (522 vs. 554). Voluntary GG DMI (552 vs. 551, $P < 0.89$) and voluntary total DDMI (331 vs. 318, $P < 0.15$)were similar for PM and AM; however, total DDMI during the digestion trial was greater for PM vs. AM (325 vs. 304). We conclude that PM GG had a greater DMD and DDMI than AM GG due to increased TNC and not due to differences in intake by the goats. Supplementation had small effects on DMI and DMD of GG.

Key Words: Gamagrass, Meat Goats, Carbohydrates

561 Afternoon harvest increases readily fermentable carbohydrate (CHO) concentration and voluntary intake of gamagrass (GG) and switchgrass (SG)baleage fed to beef steers. G. Huntington*[1] and J. Burns[1,2], [1]*North Carolina State University, Raleigh,* [2]*USDA,ARS.*

Our objective was to determine if AM (0600) vs. PM (1800) harvest affects CHO composition and voluntary intake of GG or SG stored as baleage. Iuka GG (*Tripsacum dactyloides L.*) and Alamo SG (*Panicum virgatum L.*) were direct-cut and stored as baleage in round bales wrapped in plastic. Black steers (260 ± 16 kg BW) were assigned (5 steers per treatment) to GG/AM harvest, GG/PM harvest, SG/AM harvest, or SG/PM harvest. Steers were group-housed in covered, outdoor pens with individual feeding gates. After adaptation to the facility and 14 d standardization, ad libitum intake was measured for 21d (7 d adjustment and 14 d intake estimate) followed by a 5-d digestion trial in indoor digestion crates. Silage concentrations are g/kg DM. Means differ at ($P < 0.05$). Compared to AM harvest, PM harvest had more starch (9.3 vs. 4.7), total nonstructural CHO (30 vs. 19), and monosaccharides (17 vs. 11). Compared to AM harvest, PM harvest had less acetate (13 vs. 18) and propionate (0.29 vs. 0.82), and tended ($P = 0.12$) to have less lactate (2.9 vs. 3.5) and butyrate (3.9 vs. 5.1). Compared to SG, GG had more starch (9.4 vs. 4.7), total nonstructural CHO (34 vs. 15), and monosaccharides (21 vs. 7.4). Compared to GG, SG had higher pH (5.79 vs. 5.32) and more ethanol (27 vs. 19), acetate (19 vs. 12), propionate (1.11 vs. 0.00), and butyrate (8.4 vs. 0.6), but less DM (242 vs. 324 g/kg silage), and DM concentrations of CP (97 vs. 114) and lactate (1.6 vs. 4.8). Daily DMI (2.16 vs. 1.83 % BW) and digestible DMI (1.15 vs. 0.95 % BW) were greater for PM vs. AM harvest. Serum urea N concentrations at the end of the intake phase were greater for AM (3.91 mM) than for PM harvest (2.31 mM) and tended ($P < 0.09$) to be greater for GG (3.51 mM) than for SG (2.71 mM). We conclude that increased soluble CHO content of these grasses stored as baleage caused increased voluntary intake by beef steers. Decreased serum urea N is consistent with improved retention of dietary N for PM vs. AM harvest.

Key Words: Gamagrass, Switchgrass, Beef Steers

562 Digestion characteristics of perennial ryegrass (*Lolium perenne* L.) at different stages of maturity. A. V. Chaves[1], G. C. Waghorn*[2], and I. M. Brookes[1], [1]*Institute of Food, Nutrition and Human Health, Massey University, Palmerston North, New Zealand,* [2]*Dexcel Limited, Hamilton, New Zealand.*

In vitro and *in sacco* digestion offers a rapid and inexpensive method for evaluating nutritive value of ruminant feedstuffs. The hypothesis to be tested here was that ryegrass maturation will alter rates of degradation and products of digestion and these changes will be affected by initial cutting dates (ICD) of the sward. Ryegrass pasture was mown at three dates in Spring and samples of 2 kg were harvested at 7-14 day intervals for chemical analyses and *in vitro* and *in sacco* incubations by cutting to 5 cm above soil level. An important aspect of the this experiment was the use of the fresh mincing procedure to provide material for *in vitro* and *in sacco* incubations which mimicked cow digesta. Comparison of ICD showed minor effects on the rate of change in chemical composition. This affected fibre but not CP or NSC content. Protein degradation was not affected by maturation (mean $k=0.12h^{-1} \pm 0.08$), but a higher proportion was released into the soluble (A) fraction with mature grass (A=52 to 72%). This appeared to indicate more extensive cell rupture of mature grass and is likely to reflect the *in vivo* situation where more extensive chewing is needed to swallow mature, compared to succulent forages. In contrast to protein, fibre degradation rate was halved as ryegrass matured ($k=0.14$ to $0.03h^{-1}$), probably as a result of cross linkages between fibre components and lignification. Estimated ME values for ryegrass were reduced from about 12.8 to 8.8 MJ/kg DM as ryegrass became mature. The ammonia production *in vitro* was a function of grass CP content, extent of release into the soluble fraction and microbial utilisation. One effect of maturation was a brief period of ammonia surplus followed by insufficiency for microbial growth, but the rate and amounts of VFA produced were not affected by forage CP content or ammonia concentration. Maturation had little effect on proportions of VFA. The hypothesis was proven in part; maturation did alter rates of degradation but products of digestion were less affected by maturation and the proportion of N degraded was similar for all maturities.

Key Words: Forage Maturity, Ryegrass, Nutritive Value

563 Effects of beef cow grazing management on sediment and phosphorus losses from smooth bromegrass pastures. M. Haan*[1], J. Russell[1], W. Powers[1], S. Mickelson[2], R. Schultz[3], and J. Kovar[4], [1]*Department of Animal Science, Iowa State University, Ames,* [2]*Department of Agricultural and Biosystems Engineering, Iowa State University, Ames,* [3]*Department of Natural Resource and Environmental Management, Iowa State University, Ames,* [4]*USDA-National Soil Tilth Laboratory, Ames, IA.*

To determine the impacts of grazing management on phosphorus (P) and sediment loss to surface waters five-pasture management systems were evaluated. For 3 yr, three smooth bromegrass pastures with slopes of up to 15° were divided into five 0.4-ha paddocks that were grazed by Angus cows (mean BW 632 kg). Grazing treatments included: an ungrazed control (U), summer hay harvest with winter stockpile grazing to a residual sward height of 5 cm (HS), continuous stocking to a residual sward height of 5 cm (5C), rotational stocking to a residual sward height of 5 cm (5R), and rotational stocking to a residual sward height of 10 cm (10R). In the late spring, mid-summer, autumn and early the subsequent spring of each year, rainfall simulations were conducted at 6 sites within each paddock, 3 at high slopes (7.5 to 15.0°) and 3 at low slopes (0 to 7.5°). Rainfall simulators dripped at a rate of 7.1 cm/hour over a 0.5-m^2 area for a period of 1.5 hours. Runoff was collected and analyzed for total sediment, total P, and total soluble P. Simultaneous to each rainfall simulation, measurements were taken of ground cover, penetration resistance, surface roughness, slope, soil P, soil moisture, sward height and forage mass. There was no difference in the amount of sediment in runoff across treatments. Of the variables measured, amount of sediment in the runoff was most highly correlated with percent ground cover ($r^2= 0.16$). The 5R and 5C treatments contributed the greatest amount of total and soluble P ($p<0.05$) to runoff, the 10R and HS treatments were intermediate, and the U treatment contributed the smallest amounts. High slope areas had greater surface runoff ($p<0.05$) and greater sediment flow ($p<0.05$) than did low slope areas. Forage management practices that leave greater forage residue on the pasture will reduce the amount of P potentially lost to surface waters in runoff. Pastures with high slopes are more sensitive to losses of sediment in runoff and may need to be stocked less intensively than pastures with low slopes.

Key Words: Grazing, Phosphorus, Water Quality

564 Apparent nutrient digestibility and ruminal alterations in beef steers consuming bermudagrass hay and supplemented with soybean hulls and(or) corn. J. C. Henley*, A. I. Orr, and B. J. Rude, *Mississippi State University, Mississippi State.*

Six ruminally fistulated steers (initial BW = 266 ± 36.9 kg) were utilized in a digestion trial to evaluate the performance of steers consuming soybean hulls and(or) corn while consuming bermudagrass hay. The steers were randomly allotted to one of three supplement groups: 1) soybean hulls (SBH); 2) 75% SBH + 25% corn (MIX); 3) corn (CORN). There were three collection periods of five days each. Prior to each 5-day collection, steers were adapted to their diets for 14 days, and were adapted to their individual stalls for an additional three days. Steers were housed in stalls for ten days per period (3 day adaptation, 5 day collection, 2 day in situ collection). All steers were fed their respective supplement at 1.5% BW at approximately 0800 each day and had ad libitum access to bermudagrass hay throughout the trial. There were no differences ($P > 0.05$) among treatments for dry matter, organic matter, or crude protein apparent digestibilities. However, steers consuming SBH and MIX had greater ($P < 0.05$) apparent digestability of NDF (64.9 and

62.7%, respectively), ADF (65.4 and 63.2%, respectively), and hemicellulose (64.0 and 61.8%, respectively) compared to steers fed corn (51.9, 48.7, and 55.0%, respectively). No differences ($P > 0.05$) were found for total VFA or individual VFA concentrations among treatments. However, isobutyrate and isovalerate as a percentage of total VFA decreased ($P < 0.05$) with time after steers consumed their supplement. Valerate concentrations increased ($P < 0.05$) for approximately 6 hours after consuming supplements, and then decreased by 8 hours post consumption. Ruminal pH decreased ($P < 0.05$) from 6.93, 6.85, and 6.80 for CORN, SBH, and MIX, respectively to 6.30, 6.11, and 6.05, respectively. Supplementing steers with soybean hulls was not affected by addition of corn. However, supplementing with corn decreased fiber digestion. Use of soybean hulls as a supplement may improve animal fiber utilization compared to corn only when consuming hay.

Key Words: Soybean Hulls, Supplementation, Digestibility

565 Evaluation of different backgrounding programs for weaned beef calves. K. H. Hunter*, A. M. M. Shank, R. K. Shanklin, W. S. Swecker, J. P. Fontenot, G. Scaglia, and C. L. Pickworth, *Virginia Polytechnic Institute and State University, Blacksburg*.

Sixteen trials were conducted during 4 yr with 716 animals (552 steers and 164 heifers) (approximately 200 kg) to evaluate the effects of various regimens on performance and health during the backgrounding period (42 d) from weaning to stockering. Thirteen trials were conducted on pasture and three in drylot. All trials had a minimum of two replicates. Grazing trials were on stockpiled fescue-based pastures, and fescue hay was fed in the drylot trials. Grazing calves were fed different supplements with CP levels of 15, 16, 17.4, and 30% at rates of 0, 0.5, and 1.0% BW in different trials. Supplements included corn + SBM, soy hulls + SBM, corn gluten feed + soy hulls, alfalfa pellets, and a 50% hay mixture. Data for all trials were analyzed using the GLM procedure for analysis of variance for a completely randomized block design. Tukey's one way analysis of variance test was used to compare treatment and forage type effects and interactions. Usually, supplemented calves had higher ADG ($P < 0.05$) than unsupplemented calves. Similar ADG were observed when supplementation was provided at 0.5 and 1.0% BW ($P > 0.05$), suggesting that supplementation of calves at more than 0.5% BW is not advantageous. Similar gains were observed across all grazing trials with supplementation at 15, 16, 17.4, and 30% CP levels. Cattle supplemented with by-product feedstuffs (corn gluten feed + soy hulls and soy hulls + SBM) performed comparably to those supplemented with corn + SBM ($P > 0.05$). There were no differences in ADG between unsupplemented animals grazing either fescue pastures or fescue-alfalfa pastures. In drylot, animals supplemented with concentrate had higher ADG ($P < 0.05$) than unsupplemented animals. Low levels of protein supplementation improves performance of calves grazing stockpiled forage.

Key Words: Beef Cattle, Forages, Backgrounding

566 Impact of stocking rate and stocking strategy on gain per animal and gain per hectare of steers grazing rotational or continuous stocked rye-ryegrass pasture. J.J. Cleere*[2], F.M. Rouquette, Jr.[1], and G.M. Clary[2], [1]*Texas Agricultural Experiment Station, Overton*, [2]*Texas Cooperative Extension, Overton*.

Selecting appropriate stocking rates for winter annual pastures used for stocker cattle requires knowledge about the environment and forage growth attributes as well at management experience. Sod-seeded Maton rye and TAM 90 annual ryegrass pastures were grazed by Bonsmara x Beefmaster steers from December 18, 2002 to May 14, 2003 to quantify effects of stocking rate (SR), stocking method (SM), and stocking strategy (SS) on gain per animal and gain per hectare. Replicate pastures ($n = 2$) with ($n = 4$) steers each were used for each of the following treatments: 1) Stocking Rates; Low (LO, 2.5-238 kg steers/ha initially) and Medium (ME, 4.9-238 kg steers/ha initially). 2) Stocking Methods; Continuous (CN) and eight-paddock Rotation (RT, 2-d residence and 14-d rest). 3) Stocking Strategies; Fixed SR (FX, SR was fixed during the entire grazing period) and Variable SR (VR, initial SR were fixed until early March and then both LO and ME SR were increased to 7.4 hd/ha until termination). Animal ADG ranged from 1.22 to 1.28 kg/d for all low stocked pastures with no differences across SM or SS. Effects of stocking treatments on ADG became more apparent at ME stocking rate with the RTVR exhibiting 0.17 kg lower ADG ($P = 0.02$) than the CNFX steers (CNFX = 1.18, CNVR = 1.14, RTFX = 1.05, and RTVR = 1.01 kg/d). The slight decline in ADG with VR strategy compared to FX was likely due to reduced forage availability in late spring. Differences in gain per animal were not detected between FX and VR at any one stocking rate with the exception of a difference in the ME-CNFX and ME-RTVR (152 vs 129 kg; $P = 0.02$). This may indicate that increased stocking via VR strategy in early March increased forage utilization with little negative impact on gain per animal. Gain per hectare ranged from 426 kg/ha on the LO-FX for both CN and RT to 884 kg/ha on ME-CNVR and 853 kg/ha on LO-CNVR. The opportunity to increase stocking rate on the rye-ryegrass pastures during spring increased forage growth can double the gain per hectare.

Key Words: Stocking Rate, Pasture, Animal Gain

567 Accuracy of intake measurements for cows grazing grass/legume pastures using the alkane marker technique. G. C. Waghorn*, S. L. Woodward, and D. A. Clark, *Dexcel Limited, Hamilton, New Zealand*.

Measurement of feed intakes of individual cows grazing perennial ryegrass (Lolium perenne L.) based pastures in New Zealand has favored use of alkane markers, in part because forage digestibility is not required for intake calculation. Estimates of DMI are based on recovery of odd chain length (C31 and C33) plant cuticular waxes (alkanes) in conjunction with twice daily administration of a synthetic even chain (C32) alkane marker. However some researchers have expressed concern over the accuracy of intake estimates. Implicit in this methodology is an equal recovery of all alkanes used in calculations of intake. Results of indoor trials with lactating cows and some supporting data from sheep are presented to demonstrate unequal recoveries of individual alkanes from faeces. Intake calculations presented here use pasture C31 and twice daily doses of C32 to estimate intakes. In a trial with 16 cows fed pasture and given a C32 marker, mean actual daily DM intake (y) 10.7 kg $\pm$ 1.09 (mean $\pm$ SD) was lower than predicted from alkanes (x) 11.2 kg $\pm$ 1.37; where $y = 0.66x + 3.28$, $r^2=0.68$. The mean actual daily DM intake (y) of 15 cows in a separate trial (Trial 2) fed fresh pasture indoors with total faecal collection was 12.0 kg $\pm$ 1.19 compared to predicted (x) values of 10.35 kg $\pm$ 1.06; where $y = 0.77x + 1.15$; $r^2=0.75$). Recovery (% of intake) of C31, C32 and C33 from total collection of faeces in Trial 2 differed, averaging 89 $\pm$ 10.5, 101 $\pm$ 10.6 and 97 $\pm$ 15.2 respectively. Comparable values from total collection of faeces from separate groups of six sheep were 92 $\pm$ 7.1, 80, $\pm$ 6.6 and 83 $\pm$ 8.1 for pasture diets; 100 $\pm$ 7.5, 106 $\pm$ 10.3 and 90 $\pm$ 9.2 for alfalfa diets and 73 $\pm$ 12.5, 95 $\pm$ 14.8 and 57 $\pm$ 12.3 for white clover diets. The differences between faecal recovery of specific alkanes preclude an accurate prediction of intake and the standard deviations demonstrate large variations in recovery between animals. Inconsistent and contrasting alkane recovery will limit their use for estimating intakes of cattle grazing pastures.

Key Words: Alkane Markers, Pasture, Intake

568 Developing consistent relationships among fiber fractions for uniform alfalfa hay quality guidelines. D. R. Mertens*[1] and J. E. Getz[2], [1]*US Dairy Forage Research Center, Madison, WI*, [2]*USDA-Agricultural Marketing Service, Moses Lake, WA*.

Objective and uniform hay quality guidelines for market reporters are essential to ensure that hay prices are reported accurately, i.e., Good quality hay should be similar throughout the US. Our goals were to determine if relationships between ADF and NDF are consistent enough among laboratories from different regions of the US to derive a uniform equation. Fiber concentrations of alfalfa were obtained from laboratories in 15 states (ST), which provided a full range of values. To obtain a data set that was balanced, values were ranked by ADF and every nth sample was selected to obtain 40 to 50 samples per ST ($n = 625$). Residuals <3*RMSE of regression were removed as outliers ($n = 5$). The GLM Model: $Y = ST + b^*(X^*ST)$ for Y=ADF with X=NDF and Y=NDF with X=ADF was used to identify the ST with median geometric slope. Slopes of other ST were compared to the median and those ST not different ($P>.05$) were identified and used to generate pooled slopes. All ST with different slopes were compared to the pooled slope. Only one ST (CO) had slopes of ADF on NDF and NDF on ADF that differed ($P<.05$) from pooled slopes and this data was removed. The ST with

the median intercept was identified using the pooled slopes and compared to all other ST intercepts. Seven ST were not different (P>.05) from the median intercept with an average geometric intercept (GI) of 0.20 (AZ, CA, KA, MN, OR, PA, WA). Three ST had a higher average GI of 1.00 (UT, ID, NE), two ST had a lower GI of 0.95 (IL, NY) and two ST had the lowest GI of 3.08. Average GI weighted for the observations in each group was -.19. The slope of ADF versus NDF appears constant throughout the US and variation in intercepts is more likely related to laboratory differences rather than to regional differences in alfalfa. In conclusion, it is possible to identify a geometric relationship between ADF and NDF that can be used to develop uniform alfalfa hay quality guidelines for the US: ADF = -.19 + .80*NDF; n=605, R^2=.90, and RMSE=1.7.

Key Words: Fiber, Forage Quality, Alfalfa

569 Effects of purified fiber energy supplementation on digestion and ruminal parameters of steers fed cool season grass hay. H. M. Blalock* and C. J. Richards, *The University of Tennessee, Knoxville*.

Six ruminally and duodenally cannulated steers were arranged in a replicated 3 x 3 Latin square. Steers had free choice access to cool season grass hay and were supplemented with 0 (NO), 0.25 (LO) or 0.50% (HI) BW of purified fiber (60% solka floc, 40% oat fiber) prior to AM hay feeding. Periods were 18 d. On d 7 to 17, steers were intra-ruminally dosed with Cr_2O_3 followed by total fecal collection from d 12 to 17 and duodenal digesta sampling at 10 hr intervals on d 13 to 17. On d 17, Co-EDTA was ruminally dosed and rumen fluid collected at 0, 3, 6, 9, 12 and 24 hr post-dosing. On d 18, ruminal contents were evacuated, weighed and subsamples retained for bacterial separation. Forage intake and total N intake were not affected by supplementation. Total intake of DM, NDF, ADF and OM were increased ($P < 0.05$) with increased supplementation. Quantities and percentages of total tract DM, NDF, ADF and OM digestion were increased ($P < 0.05$) by supplementation. Ruminal and total tract nitrogen digestion were not affected by supplementation. Ruminal acetate and propionate concentrations were not affected ($P > 0.10$) while butyrate concentrations increased ($P < 0.01$) with supplementation. Isobutyrate, valerate and isovalerate concentrations decreased ($P < 0.01$) with supplementation. However, isobutyrate was not different between HI and LO. Ruminal pH was greatest ($P < 0.01$) for HI. Ruminal NH_3-N concentrations were decreased ($P < 0.01$) by supplementation. A TRT x Time interaction existed ($P < 0.01$) for NH_3-N due to the concentration of NO remaining relatively constant throughout the 24 hr period. Total N flow at the duodenum was not affected by supplementation. This data indicates that supplementing steers consuming cool season grass hay with fibrous energy can increase ruminal and total tract fiber digestion without affecting forage intake.

Key Words: Fiber, Digestion, Ruminant

Nonruminant Nutrition: Amino Acids

570 The optimal true ileal digestible lysine and total sulfur amino acid requirement for nursery pigs between 10 and 20 kg. J. D. Schneider*, M. D. Tokach, S. S. Dritz, R. D. Goodband, J. L. Nelssen, J. M. DeRouchey, C. W. Hastad, N. A. Lenehan, N. Z. Frantz, B. W. James, K. R. Lawrence, C. N. Groesbeck, R. O. Gottlob, and M. G. Young, *Kansas State University, Manhattan*.

An experiment involving 360 pigs (avg BW = 10.3 kg) was conducted to determine the appropriate true ileal digestible (TID) lysine and total sulfur amino acid (TSAA) requirement of nursery pigs, and consequently to determine the optimal TSAA:lysine ratio. This trial was organized as a combination of two separate experiments with one set of diets consisting of five treatments with increasing TID lysine (0.9, 1.0, 1.1, 1.2, and 1.3%) and the second set of diets consisting of five treatments with increasing TID TSAA (0.56, 0.62, 0.68, 0.74, and 0.81%). The highest level of both lysine and TSAA (1.3 and 0.81%, respectively) served as a positive control and this diet was combined as one treatment to give a total of nine treatments. Pigs were randomly allotted to 8 replications with 5 pigs per pen based on BW. Average daily gain increased (linear, P < 0.01), while ADFI decreased (linear, P < 0.06) to 1.3% TID lysine. Increasing TID lysine from 0.9 to 1.3% also improved (linear, P < 0.01; and quadratic P < 0.05, respectively) gain:feed. Increasing TID TSAA from 0.56 to 0.81% increased (linear, P < 0.02) ADG and improved (linear, P < 0.01) gain:feed. Regression analysis of the response surface resulted in an estimated TID TSAA to lysine ratio ranging from 55 to 61% for ADG and 57 to 61% for gain/feed.

	TID Lysine, %							
Item	0.9	1.0	1.1	1.2	1.3	SED	Linear	Quadratic
ADG, g	494	524	525	519	549	17.306	0.01	0.51
ADFI, g	901	881	872	842	865	36.733	0.06	0.34
Gain/ Feed	0.55	0.59	0.61	0.62	0.63	0.012	0.01	0.05

	TID TSAA, %							
Item	0.56	0.62	0.68	0.74	0.81	SED	Linear	Quadratic
ADG, g	514	528	545	540	549	17.306	0.02	0.40
ADFI, g	878	868	881	867	865	36.733	0.66	0.88
Gain/ Feed	0.59	0.61	0.62	0.62	0.63	0.012	0.01	0.34

Key Words: Total Sulfur Amino Acids, Lysine, Nursery Pigs

571 The optimal true ileal digestible lysine and threonine requirement for nursery pigs between 10 and 20 kg. N. A. Lenehan[1], M. D. Tokach[1], S. S. Dritz[1], R. D. Goodband[1], J. L. Nelssen[1], J. L. Usry[2], J. M. DeRouchey[1], and N. Z. Frantz*[1], [1]*Kansas State University, Manhattan*, [2]*Ajinomoto Heartland LLC, Chicago, IL*.

A total of 360 pigs (Genetiporc; initially 10.7 kg and 34 d of age) were used in a 17-d growth assay. This trial was conducted as a combination of two separate trials in order to simultaneously examine both the true ileal digestible (TID) lysine and threonine requirements, and determine the appropriate threonine to lysine ratio. The first part of the trial consisted of five treatments with increasing TID lysine (0.9 1.0, 1.1, 1.2, and 1.3%). The second part consisted of five treatments with increasing TID threonine (0.60, 0.66, 0.73, 0.79, and 0.85%). The highest level of both lysine and threonine (1.3 and 0.85%, respectively) served as a positive control and this diet was combined as one treatment to give a total of nine treatments. There were 8 replications with 5 pigs per pen. Both ADG and gain/feed (G/F) increased (quadratic, P < 0.02) to 1.2% TID lysine. For threonine, ADG (linear, P < 0.03) and G/F (quadratic, P < 0.04) increased to 0.79% TID threonine. Using 0.79% TID threonine and 1.2% TID lysine as the requirements yields a TID threonine to lysine ratio of 66% for both ADG and G/F. In summary, these results suggest a TID threonine to lysine ratio of approximately 66% for 10 to 20 kg pigs.

	TID	Lysine,	%					
Item	0.9	1.0	1.1	1.2	1.3	SED	Linear	Quadratic
ADG, g	532	541	587	599	582	19	< 0.01	0.02
ADFI, g	918	870	917	923	896	35	0.81	1.00
Gain/ feed	0.58	0.62	0.64	0.65	0.65	0.01	< 0.01	< 0.01

	TID	Threonine,	%					
Item	0.60	0.66	0.73	0.79	0.85	SED	Linear	Quadratic
ADG, g	563	573	577	603	582	19	0.03	0.26
ADFI, g	924	900	897	923	896	35	0.45	0.64
Gain/ feed	0.61	0.64	0.64	0.65	0.65	0.01	< 0.01	0.04

Key Words: Threonine, Lysine, Nursery Pigs