996 Forage feeding to reduce pre-harvest E. coli populations in cattle, a review. T. R. Callaway*[1], R. O. Elder[1], J. E. Keen[2], R. C. Anderson[1], and D. J. Nisbet[1], [1]*USDA/ARS-Southern Plains Agricultural Research Center, College Station, TX,* [2]*USDA/ARS-Meat Animal Research Center, Clay Center, NE.*

Although *E. coli* are commensal organisms that reside within the host gut, some enteropathogenic strains of *E. coli* can cause hemorrhagic colitis in humans. The most notable enterohemorrhagic *E. coli* (EHEC) strain is O157:H7. Cattle are asymptomatic natural reservoirs of *E. coli* O157:H7; and it has been reported that as many as 30% of all cattle are carriers of this pathogen, and in some circumstances this can be as high as 80%. Feedlot and high-producing dairy cattle are fed high grain rations in order to increase feed efficiency. Because cattle have low amylase activity, much of the starch passes to the hindgut where it is fermented. EHEC are capable of fermenting sugars released from starch breakdown in the colon, and populations of *E. coli* have been shown to be higher in grain fed cattle, and this has been correlated with *E. coli* O157:H7 shedding in barley fed cattle. When cattle were abruptly switched from a high grain (corn) diet to a forage diet, generic *E. coli* populations declined 1000-fold within 5 days and the ability of the fecal generic *E. coli* population to survive an acid shock similar to the human gastric stomach decreased. Other researchers have shown that a switch from grain to hay caused a smaller decrease in *E. coli* populations, but did not observe the same effect on gastric shock survivability. In a study that used cattle naturally infected with *E. coli* O157:H7, fewer cattle shed *E. coli* O157:H7 when switched from a feedlot ration to a forage-based diet compared to cattle continuously fed a feedlot ration. Results indicate that switching cattle from grain to forage could potentially reduce EHEC populations in cattle prior to slaughter; however the economic impact of this needs to be examined.

Key Words: Forage, Cattle, E. coli

997 Keeping *Escherichia coli* O157:H7 Down on the Farm. M. P. Doyle*[1], [1]*University of Georgia.*

E. coli O157:H7 is responsible for an estimated 73,500 cases of infection in the U.S. annually, with principal vehicles of transmission being beef, produce, water (both drinking and recreational), and cattle (handling). *E. coli* O157:H7 is carried in the intestinal tract of cattle and the pathogen's most frequent origin is direct or indirect contact with cow manure. Manure can contaminate food when used as a soil fertilizer, when it pollutes irrigation water, when cattle defecate near produce or foods of animal origin, and when intestinal contents or manure-laden hides contact carcasses during slaughter and processing. Case-control studies of patients with *E. coli* O157:H7 infections revealed that eating undercooked ground beef, living on or visiting a farm, and contact with farm animals, especially cattle, are major risk factors associated with acquiring *E. coli* O157:H7 infections. An estimated 1.36 billion tons of animal manure is produced in the U.S. annually, with greater than 90% attributed to cattle. An effective control program to substantially reduce *E. coli* O157:H7 infections will require the implementation of intervention strategies throughout the food continuum, from farm to table. Promising intervention measures at the farm include competitive exclusion bacteria, bacteriophage, innovative vaccines, and targeted animal management practices addressing common points of contamination. Most promising of these to date is competitive exclusion bacteria of which 80 to 90 percent of cattle administered probiotic *E. coli* was rid of *E. coli* O157:H7 within ca. 2 weeks posttreatment.

Key Words: *E. coli*, beef, contamination

998 Role of diet on conjugated linoleic acid content of milk and meat. T. R. Dhiman*[1], [1]*Department of Animal, Dairy and Veterinary Sciences, Utah State University, UT 84322-4815.*.

Conjugated linoleic acid (CLA) occurs naturally in many foods. However, the principal dietary sources are meat, dairy products and other foods derived from ruminants. Research studies with animal models suggest that CLA reduces the risk of cancers at several sites (mammary tissue, prostrate, gastrointestinal tract, lung, and skin), reduces body fat and enhances growth of lean body mass. Current knowledge suggests that the *cis*-9, *trans*-11 CLA isomer is probably responsible for anticancer effects, while the *trans*-10, *cis*-12 CLA isomer induces body composition changes. Milk fat CLA is 92% *cis*-9, *trans*-11 and contains no detectable *trans*-10, *cis*-12 CLA. However, beef fat has an average 78% of the total CLA as *cis*-9, *trans*-11 and 22% *trans*-10, *cis*-12 CLA. Fat from milk and beef contains an average 4.0 and 3.5 mg CLA/g of fat, respectively. Current research suggests that CLA in meat and milk fat of ruminants originates from two sources: 1. From incomplete ruminal biohydrogenation of lipids, 2. Endogenous synthesis from *trans*-11 C18:1 fatty acid. The delta-9 desaturase enzyme is responsible for the conversion of *trans*-11 C18:1 in the mammary gland. Research review shows that diet and management practices can influence the CLA content of milk and meat. Cows grazing on pasture had 500% more CLA content in milk compared with cows fed typical dairy cow diets containing conserved forage and grain in a 50:50 ratio. Feeding oils such as soybean, sunflower, peanut, linseed and fish oil to dairy cows can increase the CLA content of milk. Feeding full fat extruded soybeans and cottonseed to dairy cows doubled the CLA content of milk and cheese compared with feeding normal diet. Other factors such as feeding high grain diets and reducing the forage particle size will decrease milk fat CLA. Feeding up to 5% soybean oil to feedlot beef cattle during finishing period resulted in a small increase in CLA content of beef. Beef from steers raised on forages had 550% more CLA *cis*-9, *trans*-11 isomer, whereas steers receiving grain in back-grounding and grazed on pasture with no grain supplementation during finishing period had only 300% more CLA compared with beef from steers fed typical feedlot high grain diet. Raising beef cattle on forages and pasture with no grain supplementation can enhance the CLA content of beef.

Key Words: CLA, Milk, Meat

999 Physiological and productive responses of dairy cows to intake and characteristics of fiber. D. Sauvant*[1] and D.R. Mertens[2], [1]*INRA-Institut National Agronomique, Paris-Grignon,* [2]*US Dairy Forage Research Center, Madison, WI.*

Numerous studies have dealt with the influence of chemical and physical fiber in the diet on intake, chewing activities, digestion, metabolism and milk secretion. A database compiled from these experiments was analyzed statistically to extract multiple marginal responses of cattle to dietary fiber. The database consisted of 179 experiments (446 treatments) related to NDF or concentrate proportion in dietary DM and 53 experiments (82 treatments) dealing with the influence of dietary mean particle size (MPS). Data were analyzed with the GLM procedure to investigate relationships across and within experiments. Intake was significantly depressed as dietary NDF increased. Chewing activities decreased as dietary NDF and MPS decreased. Rumen contents were influenced by NDF intake, but not by MPS. Ruminal parameters (pH, VFA contents and profile, microbial growth, etc.) were affected in a similar manner by both NDF and MPS. These responses were consistent with data on chewing activities. Organic matter digestibility and net energy concentration were altered by dietary NDF and DMI. Raw milk yield was depressed as dietary NDF increased. Milk protein and lactose percentages were decreased at a similar rate when dietary NDF increased while the opposite occurred for milk fat percentage. Milk fat was also highly dependent on MPS. In the total database, there was consistency between milk fat percentage and parameters of digestion in the rumen, particularly pH and acetate/propionate ratio. The responses of milk secretion to dietary energy supply were studied in experiments where OM digestibility was measured. It appeared that responses of milk protein, lactose and raw yield were linear functions of energy supply, whereas the response of fat secretion was curvilinear. These responses to dietary fiber contribute quantitatively to the current debate about the concept of effective fiber in dairy cows. Meta-analysis can be used to indicate threshold values for dietary characteristics that can maintain animal health and product quality.

Key Words: Ruminal pH, Fiber, Particle size

1000 Impacts of livestock forage and pasture use on carbon sequestration and greenhouse gas emissions. D.E. Johnson*, H.W. Phetteplace, A.F. Seidl, and R. Conant, *Colorado State University, Ft Collins, CO*.

Representative models of U.S. dairy (WI, CA) and beef (AL, TX, UT, VA, WI) production systems were constructed to sum the land use requirements, greenhouse gas (GHG) emissions and product outputs. Total GHG emissions expressed, as CO2 equivalents per unit of milk were 1.4 and 1.5 kg/kg, while the production of beef as live weight at the farm gate resulted in from 13.8 to 18.2 kg/kg. The 2 dairy systems utilized 0.6 (CA) and 1.1(WI) ha of land per mature cow unit. Beef systems', including stocker and feedlot, land use was projected to range from 1 to 3.7 ha per mature cow unit. Best management practices applied to all land used in these operations is expected to store .12 and .22 Mg/cow unit for dairy systems and from .2 to .7 Mg of carbon/beef cow unit, anywhere from 4 to 50% of total system GHGs. Twenty-yr simulations of soil C were run using the Century model for 7 to 10 soil types in 3 locations assuming normal tillage operations. Changing from pasture to either hay or various grain cropping regimens generally decreased soil-C (av. -0.25 Mg/ha/yr), however, the changes were quite variable by soil type. The reverse simulation, change from grains or hay to pasture, at the third location showed wide variations also but averaged +0.28 Mg/ha/yr. Thus changing to increased pasture usage could yield additive C sequestrations above those realized from BMP's. Potential grazing land C-sequestration in the U.S. has been estimated at 4 fold the total agricultural grazing land GHG emissions. Caution must be exercised since tradeoffs, as will be discussed, can occur e.g., if reduced rate of production increases CH4/product or excess forage N enhances N2O emissions. Also, long term measurements of soil C in intensively managed pastures can show C losses as noted for a location in NZ.

Key Words: Pasture and forage, Carbon sequestration, Greenhouse gases

ASAS/ADSA Breeding and Genetics: Genetic Parameters of Beef Cattle

1001 Development and use of genetic markers to predict marbling and tenderness in beef cattle. F. L. Fluharty* and D. J. Jackwood, *The Ohio State University, Wooster, OH*.

Detecting animals with the genetic potential for superior performance or meat characteristics requires identifying those genes controlling the desired traits. Since identifying the genes controlling performance and meat characteristics is not practical at this time, genetic markers are used. These markers are used to identify a specific location, or loci, on an animal's chromosome. The key to developing a useful genetic marker is to find one that identifies the specific loci of genes responsible for the trait of interest. We have used the random amplified polymorphic DNA (RAPD) assay to identify two markers that correlate highly with marbling and four markers that correlate highly with tenderness in crossbred beef cattle. Diagnostic tests for these markers that are ultimately developed for commercial use must be relatively low cost, extremely reliable, and logistically appropriate to allow for large numbers of samples to be analyzed in a short period of time. Once an animal's genetic potential is known, management and nutritional strategies must be developed to target the animal toward a known outcome or consumer group. From the standpoint of the seedstock sector, knowing the genetic result of a planned mating shortly after the calf's birth could enhance genetic selection. Feeder calves could be sold in genetically similar groups that are targeted toward a specific consumer group and managed in the feedlot to achieve their potential. The widespread use of genetic technology could lead to a formalized market system in the cattle industry.

Key Words: genetics, markers, beef

1002 Evidence for an association between a *Hind* III PCR-RFLP at the bovine insulin-like growth factor binding protein-2 (IGFBP-2) locus and growth and carcass traits in beef cattle. M. Pagan*, J. Cowley, N.E. Raney, and C.W. Ernst, *Michigan State University, East Lansing*.

Insulin-like growth factor binding protein-2 (IGFBP-2) was selected as a candidate gene for growth and carcass merit in beef cattle. Simmental (n = 21), Shorthorn (n = 13), Tarantaise (n = 7), Angus (n = 17), Hereford (n = 17), Salers (n = 5), Red Angus (n = 1), MARC II (n = 8), and Maine Anjou (n = 11) sired cattle were genotyped for an IGFBP-2 *Hind* III RFLP that was previously identified in our laboratory. Two alleles were found to be segregating in all breeds with frequencies of 0.14 A/0.86 B for Simmental, 0.59 A/0.41 B for Hereford, 0.15 A/0.85 B for Angus, 0.3 A/0.7 B for Salers, 0.31 A/0.69 B for Shorthorn, 0.5 A/0.5 B for MARC II, 0.54 A/0.46 B for Maine Anjou, 0.5 A/0.5 B for Red Angus and 0.07 A/0.93 B for Tarantaise sired cattle. Data from the Hereford, Shorthorn and Maine Anjou breeds (AA, AB, BB genotypes represented) was analyzed for possible associations between IGFBP-2 genotypes and growth and carcass traits. A statistically significant effect of genotype ($P < 0.05$) was found for days on feed, hot carcass weight, dressing percentage, trimmed hot carcass weight, cold carcass weight, ribeye area and USDA yield grade. Animals with the BB genotype had fewer days on feed, higher hot carcass weight and higher dressing percentage than those with the AB genotype ($P < 0.05$). No significant differences were observed between AA and BB individuals or between AA and AB individuals for these traits ($P > 0.05$). For trimmed hot carcass weight and cold carcass weight, the AA and BB genotypes represented the animals with higher weights in relation to the heterozygous (AB) animals ($P < 0.05$). The BB individuals had higher ribeye areas and better USDA yield grades than the AA and AB animals ($P < 0.05$). Therefore, animals with the BB genotype appear to have more desirable growth and carcass characteristics. Results of this study indicate that an association may exist between alleles of the IGFBP-2 gene and growth and carcass traits in beef cattle. Validation of these results in additional populations is warranted.

Key Words: PCR-RFLP, IGFBP-2, Growth

1003 Effects of selection for yearling ultrasound intramuscular fat percentage in Angus bulls on carcass traits of progeny. R. L. Sapp*, J. K. Bertrand, and T. D. Pringle, *University of Georgia, Athens*.

Twenty-one Angus bulls from three purebred farms were used to determine the effects of selection for phenotypic yearling ultrasound intramuscular fat percentage (USIMF) on the carcass traits of steer progeny managed for commercial slaughter. Bulls were selected based on their high or low phenotypic USIMF within a contemporary group. Average USIMF was 4.01% (SD = 1.07, n = 10) and 1.59% (SD = 0.53, n = 11) for high USIMF (HU) and low USIMF (LU) line bulls, respectively. Each bull was randomly mated to a group of 14 to 30 purebred Angus females for 1 to 5 years. One bull from the HU and one bull from the LU were used throughout the project. Birth weight, weaning weight, yearling and carcass weight, fat thickness at the 12th rib (FAT), longissimus muscle area at the 12th rib (REA), and marbling score (MB) measurements were taken on 196 steer progeny. Carcass data were linearly adjusted to 480 d of age at slaughter. Fixed effects for all traits were birth year of calf, phenotypic USIMF line of sire, and interaction between year and line. Sire, nested within year and line, was included as a random effect. Progeny data were analyzed using the MIXED procedure of SAS. Least squares means of progeny sired by HU (LU) bulls for MB and quality grade (QG) were 447.16 ± 10.13 (408.19 ± 10.09) and 606.23 ± 5.30 (585.09 ± 5.29), respectively, where MB of 400 = small and QG of 500 - 599 = Select, 600 - 699 = Choice. Birth weight ($P < 0.05$), MB ($P < 0.02$), and QG ($P < 0.02$) were found to be larger in steers sired by HU bulls. Longissimus muscle area was larger ($P < 0.02$) for steers sired by LU bulls. Sire selection based on USIMF was effective in increasing MB and QG in steer progeny. These results suggest that yearling bull ultrasound measurements can be used as selection criteria for genetic improvement of steer carcass traits, and selection for higher levels of marbling can be obtained without increasing fat thickness.

Key Words: Ultrasound, Intramuscular Fat, Selection Response