were decreased by HS (P < 0.01). High sulfur levels may have negative consequences for ruminal fermentation.

Key Words: digestibility, sulfur, distiller's grains

256 High sulfur content in distillers grains with solubles may be deleterious to performance and carcass quality of finishing steers. S. Uwituze*[1], M. K. Shelor[1], G. L. Parsons[1], K. K. Karges[2], M. L. Gibson[2], L. C. Hollis[1], and J. S. Drouillard[1], [1]*Kansas State University, Manhattan*, [2]*Dakota Gold Research Assn, Sioux Falls, SD*.

Crossbred yearling steers (n = 76; 410 ± 2.7 kg BW) were used in a finishing trial to evaluate effects of sulfur content in dried distiller's grains with solubles (DDGS) on growth performance and carcass characteristics of finishing steers. The study was a randomized complete block design with a 2 × 2 factorial arrangement of treatments. Factors consisted of dietary sulfur concentration (0.42% and 0.65% of DM; LS and HS, respectively), and grain processing method (steam-flaked or dry-rolled corn; SFC and DRC, respectively). HS was achieved by spiking the basal diets with sulfuric acid. All diets included 30% DDGS (DM basis). Steers were blocked by weight and randomly assigned within block to treatments. Cattle were housed in individual, concrete-surfaced, partially enclosed pens equipped with feed bunks and water fountains. Steers were fed ad libitum amounts of their respective diets at approximately 0800 h each day. Steers were harvested on d 140. No interactions between grain processing method and sulfur level were observed. Steers fed diets with HS had 8.9% lower DMI (P < 0.001); 12.9% poorer ADG (P = 0.006); 4.3% lighter final BW (P = 0.006); and tended (P = 0.13) to have poorer G:F compared to steers fed diets with LS. Cattle fed HS yielded 4.3% lighter HCW (P = 0.006) and had 16.2% less KPH fat (P = 0.009) compared to steers fed LS. Steers fed HS had lower (P = 0.05) percentage of liver abscesses compared to steers fed diets containing LS and lower yield grades (P = 0.04) than their counterparts fed diets containing LS. There were no differences among treatments with respect to dressing percentage; 12th-rib back fat; REA; or USDA quality grades. Grain type had no effect (P > 0.15). Feeding distiller's grains which are high in dietary sulfur may decrease DMI and compromise growth performance and carcass characteristics of feedlot cattle.

Key Words: distiller's grains, grain processing, sulfur

257 Evaluation of feedlot and carcass performance of steers fed different levels of ECORN™, a potential new feed product from ethanol plants. C. M. Godsey-Williams*[1], G. E. Erickson[1], T. J. Klopfenstein[1], M. Greenquist[2], P. Guiroy[2], C. Ibanez[2], and J. Kazin[3], [1]*University of Nebraska, Lincoln*, [2]*Cargill Inc., Wayzata, MN*, [3]*Renessen LLC., Wayzata, MN*.

The objective of this study was to evaluate the use of ECORN™ (ECORN), a corn-based by–product from the production of ethanol and food grade corn oil, as a replacement to dry–rolled corn (DRC) in feedlot finishing diets containing wet distillers grains plus solubles (WDGS) or wet corn gluten feed (WCGF). One–hundred twenty individually–fed crossbred yearling steers (372 ±17 kg) were blocked by initial BW and assigned randomly to one of eight treatments (15 steers/treatment) in a 2x4 factorial design. Diets were formulated to contain 30% WDGS or WCGF and either 0, 20, 40, or 60% ECORN (DM basis). The diets were formulated to replace DRC with ECORN at an equal proportion of DM and all diets contained 5% corn stalks and 5% dry supplement. The ECORN product contains 10.9% CP, 1.5% fat, 0.1% S, and 17.4% NDF. Steers were fed 153 d. As the level of ECORN increased from 0 to 60% diet DM, DMI increased quadratically (P=0.04) with 20 and 40% inclusion having similar DMI (P>0.10). As ECORN increased in the diet, G:F (0.139, 0.144, 0.131, and 0.140) responded cubically (P=0.02) while ADG (1.37, 1.43, 1.33, 1.33) was unaffected (P>0.21). Linear decreases in marbling score, fat depth, and calculated yield grade were observed with increased ECORN inclusion (P<0.01); whereas, LM area responded cubically (P<0.01). Steers fed WDGS had lower DMI and greater G:F versus steers fed WCGF (P<0.02), with carcass characteristics unaffected by by-product type (P>0.17). Results of this study would suggest replacing DRC with ECORN at 20% of the diet DM would optimize G:F and offer a feeding value equal to 118% the relative value of corn. However, no difference in ADG or G:F between the 0 and 60% ECORN suggests ECORN may replace corn in diets containing WDGS or WCGF. Further research to explain decreases in marbling score, fat depth, and yield grade (with no affect on HCW) should be considered.

Key Words: finishing cattle, fractionation, wet distillers grains

Ruminant Nutrition: Forage Digestibility Estimates; Obtaining and Applying Meaningful Values

258 Opportunities and challenges in determining forage digestibility values. R. Ward*, *Cumberland Valley Analytical Services, Hagerstown, MD*.

In the last ten years, the use of NDF digestibility (NDFD) has evolved from strictly a research evaluation to a common commercially available value provided by forage laboratories. Cumberland Valley Analytical Services (CVAS) recorded requests for NDF digestibility values in excess of 820 in 2000; 13,200 in 2004; and 39,500 in 2008. Despite the wide acceptance and use of NDF digestibility values, there remain significant questions as to the appropriate use of this information for forage evaluation and nutritional modeling systems. There are no standard procedures for NDF digestibility and most systems reference a procedure by Tilley and Terry from 1963. Values generated by laboratories vary widely, and later time points have been advocated for consistency but do little more than define an asymptotic value. Reported NDFD values and associated estimates of rate are only relevant within procedures, and even then have questionable relationship to animal models. NDF digestibility values generated by a system will be dependent on drying method, grinder type and grind size, inoculum source, buffer, and type of containment system. NDF digestibility systems that generate relevant values will 1) exhibit consistency over time, 2) generate repeatability within run, 3) be sufficiently sensitive to define differences between forages, and 4) be robust across commercial laboratory settings. These objectives are critical to a laboratory providing information of value and are necessary points to be understood by users of this information.

Key Words: NDF digestibility

259 Do in vitro digestibility data have value in dairy cattle nutrition? W. P. Weiss*, *Ohio State University*, *Wooster*.

The use of ruminal in vitro (IV) digestion to evaluate feeds was first reported in the early 1900's, but for numerous reasons IV digestibility did not gain widespread use until the early 1960's when Tilley and Terry published their two-stage IV method. In vitro digestibility of forages using that method were correlated, but not equivalent, to in vivo digestibility when ruminants (most of the experiments used sheep) were fed all forage diets. The next major change in the IV method was the modification developed by Van Soest that replaced pepsin digestion with neutral detergent extraction. Several modifications have been made, but incubating a feed in rumen fluid-buffer mixture for 24 to 48 h followed by the NDF assay is the basic method used today. The question that needs to be addressed is, what do we as dairy nutritionists do with IV values? In vitro digestibility has been used to estimate energy (e.g., NEL) in feeds, although data evaluating whether this actually works are limited. Indeed, recent publications show a poor relationship between IV NDF digestibility and in vivo NDF digestibility in lactating cows fed mixed diets. Experiments are needed to determine if certain IV methods (e.g., 24 vs. 30 h incubation, donor cow diets, etc.) are better at estimating in vivo digestibility. In vitro NDF digestibility also has been used as an index of DMI by lactating cows. Within studies (meaning the IV assays were probably conducted concurrently on the different forages), cows fed diets based on forages with lower IV NDF digestibility usually have lower DMI than cows fed forages with higher digestibility. This relationship has only been shown to exist when comparisons are made within forage type (e.g., within corn silages or within alfalfa). For IV data to have greater utility for estimating relative DMI, lab results must be consistent across time so that a forage being fed today can be compared with a forage that will be available for feeding and sampling next month. Experiments with cows should either be conducted concurrently or precede studies designed to standardize this assay so that the standardized values actually have utility in diet formulation.

Key Words: in vitro, fiber digestibility, intake

260 Obtaining and applying meaningful forage digestibility estimates: Forage-fed beef. E. S. Vanzant* and J. W. Lehmkuhler, *University of Kentucky*, *Lexington*.

Knowledge of forage quality is of tantamount importance for proper nutritional management of beef cows and growing calves. Forage digestibility is generally considered to be a very useful integrated measurement of forage quality. Our discussion will examine issues associated with obtaining and applying meaningful estimates of forage digestibility in forage-based beef cattle operations. We will begin by defining what is meant by "meaningful" when applied to forage digestibility analysis. Results from sensitivity analysis using the NRC (1996) model provide us with a basis for determining desirable levels of accuracy and precision in our estimates. This information will allow us to address the ramifications of errors in digestibility estimates with a focus on both animal performance and economic implications. Next, we will address current practices by presenting results from a survey of university research and extension personnel as well as commercial forage analysis laboratories. Survey results will illustrate the current range in practices associated with each step in the forage analysis process, including sampling methodologies, laboratory procedures, and application of results. Finally, to determine the need for further improvements in the acquisition and utilization of forage digestibility estimates, we will evaluate the current practices in light of our definition of "meaningful forage analysis".

Key Words: forage, digestibility

261 Addressing fiber digestibility in low-forage diets. N. DiLorenzo and M. L. Galyean*, *Department of Animal and Food Sciences, Texas Tech University*, *Lubbock*.

To optimize efficiency of production and cost of gain, inclusion of fiber in finishing diets is typically decreased to the minimum necessary to maintain a healthy rumen and to maximize NEg intake. From an energetic standpoint, the contribution of the fiber fraction in typical feedlot diets with low inclusion of high-fiber coproducts is likely not greater than 4% of the total DE/kg of dietary DM. The energy contribution depends largely on the extent of fiber digestibility, which is influenced by grain source and processing, as well as roughage concentration, source, and processing. Measuring NDF digestibility is challenging with high-grain diets because of the interference with starch in the analytical method. Thus, ADF digestibility (ADFd) is often reported in the literature to assess the digestibility of the fiber fraction in low-roughage diets. Ruminal ADFd seems to be less in steam-flaked corn-based diets (SFC) than in dry-rolled corn-based diets (DRC), perhaps reflecting the decreased ruminal pH for SFC vs. DRC, with associated negative effects on ruminal cellulolysis. A meta-analysis of literature data with high-concentrate diets revealed no relationship between dietary ether extract (% of DM) and ruminal (P = 0.30) or total tract (P = 0.53) ADFd, but a tendency (P = 0.09) was noted for a linear decrease in ruminal ADFd with increasing ADF from the roughage portion of the diet (rADF). No relationship (P = 0.67) was noted, however, between rADF and total tract ADFd, indicating that postruminal digestion of fiber might compensate for decreased ruminal ADFd. A previously conducted meta-analysis indicated a positive linear relationship (r^2 = 0.96) between dietary NDF and DMI by beef cattle fed diets ranging from 7.5 to 35.3% NDF. Thus, the effects of rADF on ruminal ADFd might be mediated by an increased DMI with increasing roughage concentration and associated effects on rate of passage and mean retention time of fiber. Research is needed to characterize the fiber fractions in various high-fiber coproducts, as well as their effects on rate of passage, intake, and ruminal fermentation.

Key Words: acid detergent fiber, high-concentrate diet, ruminal and total tract digestion

262 Attempting to apply meaningful forage values and digestibility estimates in commercial feedlot diets. T. M. Peters*, S. P. Montgomery, and S. J. Bierman, *Corn Belt Livestock Services*, *Rock Falls, IL*.

The practice of adding forage to feedlot diets benefits the rumen environment by decreasing the risk of digestive disorders. Research shows that adding increasing forage amounts to high energy, starch-based finishing diets often increases DMI of cattle but may decrease ADG and G:F. On a NE basis, forages are typically the most costly of ingredients, thus nutritionists often include forage at minimal concentrations in finishing diets. Research has demonstrated that forages can be substituted for one another based upon their NDF concentration. Therefore, forages containing increased NDF concentrations can potentially be included in finishing diets at lower concentrations, ultimately providing finishing diets with greater NE values while preventing digestive disorders. However, forage particle size may affect forage effective NDF value and should be considered when formulating finishing diets. Forage particle size, length, as well as type are often subjective quantifications assigned by different nutritionists. Data indicate that the degree of forage processing may have little effect on growth performance if NDF is similar among processing methods. Nutritionists often question if this statement is accurate, when associated with differing grain processing methods and (or) grain by-product inclusion. Survey data indicate fiber

analysis methods used by feedlot nutritionists consist of crude fiber, NDF, ADF or that no fiber analysis is used. Nutritionists continue to apply different criterion and personal biases when assigning dietary fiber levels and forage types in finishing diets. Reasons for differing forage levels in finishing diets among nutritionists appears to be based upon environmental conditions, cattle type or management ability among feedlots. Particle separation of forage has been used to measure effective fiber concentrations in finishing diets. Methods to better evaluate NDF level and forage digestibility in finishing diets should continue to be evaluated and reported.

Key Words: digestibility, feedlot diets, forage

Swine Species

263 Birth weight implications for reproductive parameters in boars. F. R. C. L. Almeida*[1], A. L. N. Alvarenga[1], G. R. Foxcroft[2], and H. Chiarini-Garcia[1], [1]*Federal University of Minas Gerais*, *Belo Horizonte, Minas Gerais, Brazil*, [2]*University of Alberta*, *Edmonton, Alberta, Canada*.

Selection for prolificacy appears to have created an imbalance between the number of conceptuses surviving to the post-implantation period and uterine capacity. These animals show characteristics of Intra-Uterine Growth Restriction (IUGR) due to a great competition among fetuses for nutrients and oxygen, resulting in lighter fetuses at term. The effects of IUGR on testes development have not been demonstrated so far. Newborn male pigs (n = 6; DanBred X PIC terminal line), born to 4th - 6th parity sows and in litters of 10 to 15 pigs, were identified as falling into two birth weight groups: high (HW: range 1.8 to 2.2 kg) and low (LW: range 0.8 to 1.2 kg). They were castrated at 7 days post-partum for evaluation of testicular morphological characteristics. Evidence of IUGR on testis development was analyzed by comparing the mean numbers of gonocytes and Sertoli cells present in twenty cross sections of testicular cords per testis chosen at random. Data were analyzed as a fully randomized design and the comparison between means was performed by t-test. LW offspring had lighter testes and lower gonadossomatic index (GSI = testes wt/body wt x 100) compared to their HW counterparts. Moreover, the numbers of gonocytes and Sertoli cells per testicular cord were also lower in LW piglets (Table 1). These results show that light weight animals have smaller and less developed testes relative to body weight. As Sertoli cell number established before puberty determines adult testes size and sperm production, light birth weight boars may have lower reproductive performance. We gratefully acknowledge Fapemig and CNPq for funding this work. Reproductive characteristics in low (LW) and high (HW) birth weight boars born to multiparous sows and into litters of 10 to 15 pigs ($P < 0.0001$ for all parameters)

Table 1.

Parameters	LW	HW	SEM
Birth wt (kg)	1.17	2.02	0.014
Weight at d7 (kg)	2.03	3.30	0.029
Mean testicular weight (g)	0.44	0.97	0.014
GSI (birth)	0.038	0.048	0.0007
GSI (castration)	0.021	0.029	0.0004
Gonocyte / testicular cord	0.870	1.580	0.090
Sertoli cell/ testicular cord	19.22	22.36	0.419

Key Words: testes, sertoli cells, gonocytes

264 Effect of ambient temperature and light intensity on reproduction in mature gilts. D. Canaday*, B. Yantis, A. Visconti, J. Salak-Johnson, and R. Knox, *University of Illinois, Champaign-Urbana*.

The effect of variation in the environment for sows housed in crates on animal reproduction and well-being is uncertain. The objectives of this study were to determine whether differences in temperature and lighting would have a detrimental impact on fertility measures for gilts housed in crates. In replicate one, thirty-six mature cyclic gilts were synchronized with Matrix. At last Matrix feeding (LMF), gilts were assigned by age and weight in a 3 x 2 factorial treatment design to an ambient room temperature (HOT: 30°C, THERMAL NEUTRAL [TN]: 20°C, COLD: 16°C) and lighting intensity at pig level (DIM: 40 Lux, BRIGHT: 350 Lux). Estrous detection and real-time ultrasound (RTU) were performed daily from LMF until ovulation to determine onset of estrus and assess follicle growth and ovulation, respectively. For all gilts, AI occurred at onset of estrus and 24-h later. Measurements of feed intake, body temperature and weight occurred weekly. All gilts were sacrificed on day 30 and reproductive tracts evaluated for ovarian status, pregnancy and litter characteristics. Data were analyzed in SAS using Proc Mixed for the effect of temperature and lighting on response variables. Our preliminary results showed no significant effect of temperature and lighting, nor any interaction, on expression of estrus (100%), LMF to estrus (130 h), duration of estrus (58 h), gilts ovulating (100%), number of corpora lutea (17 ± 3.5), pregnancy rate (97%), litter size (14.0 ± 3.8), fetal weight (2.3 g) or fetal length (26.6 mm). Measures of within litter variation for fetal weight (0.32 ± 0.1 g) and length (1.1 ± 0.4 mm) also did not differ. Rectal temperature (38.4 ± 0.73°C) and daily feed intake (2.7 kg) did not differ among treatments. Initial body weights were not different (141.8 ± 1.8 kg), but weight gain during the treatment period was affected ($P < 0.01$) by temperature (COLD: 25.1; TN: 29.6; and HOT: 30.0 kg). These preliminary results suggest that wide temperature and lighting levels may have little effect on reproduction during breeding and early gestation in gilts housed in gestation crates.

Key Words: housing, reproduction, temperature

265 Cloning and expression of porcine lactoferrin N– lobe gene in *Pichia methanolica* and effects of recombine protein on growth performance of weanling piglets. F. Han*, Y. Xie, Y. Liu, Y. Gao, and Y. Wang, *Institution of Feed Science, Zhejiang university*, *Hangzhou, Zhejiang, China*.

The porcine lactoferrin N–lobe (PLF–N) gene was cloned from mammary gland cells of lactating sows, inserted into the recombinant plasmid pGEM–3Z–PLF–N and sequenced. This analysis indicated that the cloned gene sequence is 1038bp in length and is 99% identical to the published sequence (Gene bank L77887). PLF–N was amplified using two new primers with the template pGEM–3Z–PLF–N and cloned into pMET–B, subsequently was linearized and transformed into PMAD11 competent cells by eletroporation. Ade^+ (Mut^s) recombinants were selected by PCR and Mut phenotype determination. SDS–PAGE and western blot results showed that PLF–N was extracellularly expressed in *Pichia methanolica* successfully. The yeast powder containing 10 g/kg