kinetics were analyzed using PROC NLIN in SAS the resulting data was analyzed as a Latin-square design using PROC MIXED in SAS. Forage quality was analyzed as a completely random design using PROC GLM in SAS. The BMR varieties were lower (P < 0.01) in ADF and NDF at all harvest dates, while N concentrations were not affected (P > 0.41) by variety. The A fraction of DM and NDF was higher (P < 0.01) and the C fraction of DM, NDF, and ADF was lower (P < 0.01) for BMR than non-BMR. The B fraction of DM was not affected (P = 0.15) by variety, while the B fraction of ADF was higher (P < 0.01) in BMR than non-BMR. The B fraction of NDF was not different (P = 0.28) on d 34, but was higher (P < 0.01) on d 48 and 63 for BMR than non-BMR. The A fraction of DM and ADF was higher (P < 0.01) and B fraction of ADF was lower (P < 0.01) for MS605 DS compared to Nutri + Plus BMR. Rates of DM and NDF disappearance were higher for BMR than non-BMR for all harvest dates (P < 0.01). Disappearance of ADF was faster (P < 0.01) with BMR than non-BMR on d 48 and 63. Effective degradability of DM, NDF, and ADF was higher (P < 0.02) for BMR than non-BMR at all harvest dates.

Key Words: Sorghum x Sudan grass Hybrids, Forage, In Situ Disappearance

395 Effect of genotype and maturity on ensiling characteristics and chemical composition of millet forage.

F. Hassanat*, A. Mustafa, and P. Seguin, McGill University, Ste-Anne-de-Bellevue, QC, Canada.

A study was conducted to determine the effects of genotype and stage of maturity at harvest on ensiling characteristics, microbial population, and chemical composition of forage millet. Regular (RM) and brown midrib (BM) millet were made at vegetative (VS) and heading stage (HS), then ensiled in mini-silos for 0, 2, 4, 8, 16, and 45 d in triplicates. Both millet types were well ensiled and had a pH less than 4.2 after 45 d of ensiling. Both RM and BM millet harvested at HS had more (P<0.05) water soluble carbohydrates (16.08 and 17.82%) than when harvested at VS (11.13 and 12.25%), respectively. This was reflected in lower pH in BM silage harvested at HS compared with those harvested at VS (P<0.05) at any day of ensiling. Most protein decomposition occurred between 0d and 8d of ensiling, where 40-50% of true protein (TP) was lost to non-protein nitrogen (NPN) for the two millet types at any stage of maturity. Changes in the microbial population during ensiling were similar for the four treatments. There was an increase in the lactic acid bacteria population in the first 2d of ensiling. Enterobacteria population similar for the four treatments. There was an increase in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments. Changes in the microbial population during ensiling were similar for the four treatments.

Key Words: Millet, Brown Midrib, Inoculation

397 Lignin concentration of whole plants and stems of BT corn hybrids.

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There have been inconsistent reports regarding whether corn (Zea mays) hybrids with the Bacillus thuringiensis (Bt) cry1 Ab transgene contain more lignin than non-Bt hybrids of similar genetic background. Our objective was to evaluate the potential impact of the cry1 Ab transgene on lignin concentration (using three different assays), yield, and forage quality traits of corn silage. Replicated trials were conducted at four locations in Minnesota with 12 commercial hybrids (three MON810 and three Bt11 cry1 Ab event hybrids, and respective near-isogenic controls). Whole plants and the fourth elongated, above-ground internodes were harvested at silage maturity. Samples were analyzed for crude protein, starch, neutral detergent fiber (NDF), acid detergent fiber, 24- and 96-h in vitro ruminal NDF digestibility, and lignin (acid detergent, Klason, and acetyl bromide). European corn borers (Ostrinia nubilalis) were not controlled and plant damage from this source was limited to the non-Bt hybrids, averaging 1.5 internodes per plant with tunnels. Growth environment impacted all measures of corn hybrid performance and quality, as evidenced by significant location effects. Comparisons of non-Bt/Bt hybrid pairs, for both whole plants and internodes, found no consistent differences in yield, nutrient content, in vitro ruminal NDF digestibility, or lignin concentration. Differences in lignin concentration (for all three analysis methods) were infrequent, small in magnitude, and limited to a few non-Bt/Bt hybrid pairs at individual locations. Bt hybrids were both higher and lower in lignin concentration than their non-Bt counterparts. Two non-Bt/Bt hybrid pairs did not differ in lignin concentration at any location. Contrary to some earlier reports, presence of the cry1 Ab transgene did not alter lignin concentration or other forage quality traits of corn stover in commercial maize hybrids.

Key Words: Corn Hybrids, Lignin, Fiber Digestibility

398 Muscle fiber characteristics are important in the relationship between birth weight and carcass quality in pigs. C. Rehfeldt*, G. Kuhn, I. Fiedler, and K. End, Dept Muscle Biology and Growth, Research Institute for the Biology of Farm Animals, Dummerstorf, Germany.

It is commonly recognized that low birth weight in piglets correlates with decreased survival and lower postnatal growth rates. The aim of this study was to investigate the relationships between birth weight, carcass quality and skeletal muscle fiber characteristics. At birth, three piglets (lightest, but > 800 g; middle-weight; heaviest) were selected from each of 36 litters. The lightest piglets exhibited the smallest percentages of

Key Words: Forage Millet, Brown Midrib, Chemical Composition

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meat, total protein, total fat, the lowest Semitendinosus muscle (ST) weight and total fiber number, whereas the percentages of internal organs, skin, bone, and total water were highest. The remaining piglets were grown up at ad libitum feeding. Differences in daily gains paralleled the differences in birth weights (P=0.07). At day 182 of age 58 pigs were randomly selected for slaughter. They were assigned to one of three birth weight classes (25% low; 50% middle; 25% heavy). The pigs of low birth weight had lower live weights (P<0.05), smaller mean percentages (P=0.09) and loin areas (P=0.08) compared to pigs of high birth weight, whereas the percentage of internal adipose tissue tended to be higher (P=0.11). In addition, pigs of low birth weight exhibited lower relative heart weights (P<0.02) and a higher drip loss (P<0.08) in Longissimus muscle (LD). The pigs of low birth weight exhibited the lowest muscle fiber numbers, the largest fiber size, the highest myonuclear number per fiber, and the highest percentages of abnormal giant fibers in ST and LD muscles (P<0.05). The results suggest that the deficiency in muscle fibers by genetic or maternal reasons in low birth weight piglets cannot be equalized by accelerated fiber hypertrophy and that in these pigs extremely large fibers may be one of the reasons for poor carcass quality at slaughter.

Key Words: Growth, Body Composition, Intrauterine Growth Retardation

399 Nutrition of Wagyu- and Piedmontese-sired fetuses alters newborn longissimus muscle cellular characteristics. P. L. Greenwood1,2, H. Hearshaw1, G. Kelly1,3, and W. Hennessy1,3, 1 CRC for Cattle and Beef Quality, Armidale, NSW, Australia, 2NSW Agriculture, Armidale, NSW, Australia, 3University of New England, Armidale, NSW, Australia, 4 NSW Agriculture, Grafton, NSW, Australia.

Longissimus lumborum muscle was studied in low and high birth weight Wagyu-(mean ± SEM birth weights 27.3 ± 1.1 kg, n=8 [WL]) vs 33.4 ± 1.4 kg, n=8 [WH]) and Piedmontese-sired (27.4 ± 1.9, n=7 [PL] vs 40.2 ± 1.5 kg, n=8 [PH]) female calves following low or high nutrition of their Hereford dams during pregnancy. Muscle weight was greater (P<0.05) in Piedmontese-sired and high birth weight newborns (WL, WH, PL, PH means; pooled SE= 84, 101, 91, 150; 7g, respectively). Number of satellite cells relative to myofibre-related nuclei (6.7, 8.8, 8.3, 9.1; 0.8%) and myofibres (29.9, 36.8, 35.6, 41.8; 3.6 per 1,000 myofibres) tended (P>0.10) to be greater in high birth weight calves. Mass of muscle DNA (53.9, 52.5, 63.5, 78.8; 4.1 mg), RNA (229, 259, 267, 390; 26 mg) and protein (13.0, 16.1, 14.0, 23.7; 1.4 g) were greater in Piedmontese-sired calves, and mass of protein was greater in high birth weight calves which also tended to have more RNA. Number apparent of myofibres (29.8, 29.8, 32.2, 30.4; 2.5 x 105 myofibres) did not differ (P>0.10) due to genotype or prenatal nutrition. Percentage of type 1 myofibres was higher in Wagyu-sired and high birth weight calves (19.5, 25.0, 14.9, 21.6; 1.6%), and percentage type 2A myofibres (28.5, 23.1, 27.8, 23.9; 2.1%) and the ratio of fast to slow myofibres (4.4, 3.0, 6.9, 3.9; 0.8) increased with lower prenatal nutrition and tended to be greater in Piedmontese-sired calves. Cross-sectional area of type 2B myofibres was reduced by low birth weight (666, 751, 679, 910; 74 µm²) which also tended to influence average cross-sectional area of myofibres (597, 573, 505, 668; 56 µm²). The results demonstrate that maternal nutrition and low birth weight can impact on size, contractile and metabolic properties of myofibres in newborn calf and may affect relative numbers of myosatellite cells. It remains to be established whether nutritionally altered cellular characteristics in muscle of newborn heifers with high muscle growth (Piedmontese-sired) or high marbling (Wagyu-sired) potential have long-term consequences for growth, body composition and altered cellular characteristics in muscle of newborn heifers with high birth weight (666, 751, 679, 910; 74 µm²) may also be associated (P<0.10) with allometric relative heart weights (P<0.02), and percentage type 1 myofibres (0.5 vs 3.2 ng/mL; 4.0 vs 3.5 ng/mL T₃), and less (P<0.001) testosterone (0.5 vs 3.2 ng/mL). Serum LDH activity, when corrected for hemoglobin concentration, was lower (P<0.05) in calves that ultimately graded USDA Choice when compared with animals that resulted in USDA Select carcasses. Serum concentrations of IGF-I and cortisol at weaning were associated with an interaction (P<0.1) of quality grade and yield grade. Yield grade was associated (P<0.1) with weaning LDH activity, and testosterone concentrations. These data support previous studies indicating that serum LDH activity could be used as an early indicator of a calf’s probability to grade USDA Choice or better.

Key Words: Cattle, Lactate Dehydrogenase


High energetic costs for standing versus lying (130 kJ/kg⁰.⁷⁵ /d) in prernniant calves were mentioned in several experiments. Behaviour, and particularly stereotyped behaviour, can contribute to energy expenditure almost threefold (+74 kJ/kg²/d) compared to standing idle (39 kJ/kg²/d), while tongue playing during lying was energetically more expensive (+25 kJ/kg²/d) than lying idle (1 kJ/kg²/d). It can be concluded, that energetic costs for stereotyped behaviour are considerable, and account for up to 8 (lying) and up to 15% (standing) of the energy expenditure for maintenance. As stereotyped behaviour is more frequently shown in standing as opposed to lying calves, this affects estimation of posture-related energy expenditure.

Key Words: Cattles, Behaviour, Energy Expenditure

401 Relationships between serum constituents at weaning and subsequent carcass characteristics of beef calves. J. May1, M. Looper2, C. Golden1, M. Nihsen1, K. May1, and C. Rosenkranz Jr.4, 1Department of Animal Science, University of Arkansas, Fayetteville, 2USDA-ARS, Dale Bumpers Small Farms Research Center, Booneville, AR, 3Caldwell Farms, Rosebud, AR.

Fall born Brangus-crossbred calves (n = 112; BW = 224 ± 12 kg) were used to determine the relationship between serum constituents at weaning and carcass characteristics. At weaning, calves were weighed, blood samples were collected, and bull calves castrated two days later. After the stocker phase (145 d), calves were weighed and then finished in a commercial feedlot. Serum samples were analyzed for lactate dehydrogenase (LDH) activities, hemoglobin, protein, creatinine, prolactin, triiodothyronine (T₃), thyroxine, cortisol, testosterone, and insulin-like growth factor-I (IGF-I). After harvest, longissimus muscle and rib fat thickness were measured. In addition, USDA quality and yield grades were assigned to each carcass. A retrospective ANOVA was conducted with quality grade, yield grade, and calf gender in the model as independent variables and serum constituents as dependent variables. At harvest, 65% of the carcasses were assigned USDA Choice grade. Carcass distributions among USDA yield grade were 22, 48, and 29%, respectively for grade 1; 2, and 3. Heifers had higher (P<0.05) concentrations of cortisol and T₂ than bulls at weaning (32 vs 20 ng/mL; 4.0 vs 3.5 ng/mL T₃), and less (P<0.001) testosterone (0.5 vs 3.2 ng/mL). Serum LDH activity, when corrected for hemoglobin concentration, was lower (P<0.05) in calves that ultimately graded USDA Choice when compared with animals that resulted in USDA Select carcasses. Serum concentrations of IGF-I and cortisol at weaning were associated with an interaction (P<0.1) of quality grade and yield grade. Yield grade was associated (P<0.1) with weaning LDH activity, and testosterone concentrations. These data support previous studies indicating that serum LDH activity could be used as an early indicator of a calf’s probability to grade USDA Choice or better.

Key Words: Cattle, Lactate Dehydrogenase
supplementation (n = 30) or 1.4 kg/d per steer of a corn-soybean meal supplement (n = 15; 12% crude protein). Within supplementation strategy, steers were assigned to either no implant, one implant at d 0 and one implant at d 56 (EI), or one implant at d 56 (LI). Steers were weighed at the initiation and termination of experiment to determine average daily gain (ADG). Blood samples were collected on d 0, 62, and 108, and blood metabolites were quantified. Supplemented steers had greater (P < 0.0001) ADG than non-supplemented steers (0.93 ± 0.05 vs. 0.57 ± 0.04 kg/d, respectively). Implanted steers (EI and LI) tended to have increased (P = 0.13) ADG compared with non-implanted steers. Concentrations of prolactin and T4 were decreased (implant x time; P < 0.05) in control and LI (one steroid implant) steers but not EI (two steroid implants) steers at 108 d compared to d-62 concentrations. Cortisol was influenced by a supplement x implant interaction (P < 0.05). Supplemented EI steers had increased cortisol compared to supplemented LI steers (58.8 ± 10.0 vs 35.3 ± 9.2 ng/mL for EI and LI steers, respectively). However, non-supplemented LI steers had increased concentrations of cortisol compared with non-supplemented EI steers (56.8 ± 6.6 vs 42.2 ± 6.4 ng/mL for LI and EI steers, respectively). Supplemented steers, independent of timing of implantation, had increased (P < 0.001) concentrations of IGF-I compared with non-supplemented steers (211.5 ± 19.9 vs 122.7 ± 11.8 ng/mL, respectively). Concentrations of T4 at d-0 were positively correlated (P < 0.05; r = 0.33) with ADG of steers. Management strategies may alter animal physiology, and those strategies should be considered when using physiological markers for the prediction or selection of animal growth.

Key Words: Steers, Thyroxine, Insulin-like Growth Factor-I

403 A mechanistic nutrition model to evaluate beef cow efficiency. L. O. Tedesco1*, D. G. Fox1, M. J. Baker1, and K. L. Long2, 1 Cornell University, Ithaca, NY, 2 Bell Ranch, Solano, NM.

The beef cattle seedstock industry is searching for ways to select for improved beef cow efficiency. Most selection indices for efficiency have a goal of using less resource while obtaining the same outcome in a sustainable environment. However, the inputs required to determine individual beef cow feed efficiency are not readily available in practical conditions. A mathematical model was developed to use inputs readily available in each production situation to estimate the ratio of cow ME required to call-wearing weight (WY) for computing an energy efficiency index (EEI). This model ranks EEI estimates and compares individual cow EEI with the range of expected EEI using Monte Carlo (MC) methods to identify the upper and lower cutoff values. It uses the 2000 Beef NRC recommendations as implemented in the Cornell Net Carbohydrate and Protein System for energy requirements for maintenance, lactation, and pregnancy. Data containing varying levels of milk and forage intake of individual calves during the first 200 d after birth was used to develop a submodel to estimate call forage and peak milk intake (PKM) based on call BW and forage composition. A database collected from the Bell Ranch, NM (N = 192) was used to evaluate the ranking from most to least efficient cows. The simulation indicated that as peak milk (PKM) increases, WW increases almost linearly, the difference in the call WW between small and large cows tended to increase, and EEI estimates improve exponentially. As PKM increased, the EEI difference between small- and large-size cows decreased. The model-predicted least efficient cows were in agreement with culling decisions made prior to evaluating the EEI ranking. The MC simulation based on the distribution, mean, and variability of cow BW, PKM, and forage quality indicated that cows having EEI lower than 30.6 or higher than 38 Mcal/kg are within the 10% more and less efficient cows, respectively. Our analysis suggested this model could assist beef producers in identifying the most and least efficient cows for their resource, and can be used to simulate different production scenarios to identify the best match of cow type to alternative management systems.

Key Words: Modeling, Simulation, Production

404 Mineral and chromium supplementation to diets of finishing pigs. B. V. Lawrence*, D. Overend, S. A. Hansen, J. D. Hahn, and J. Hedges, Hubbard Feeds Inc., Mankato, MN.

A total of 763 terminal Duroc cross barrows and gilts (Compart Boar Store Line 442 X D1090; 29.8 ± 1.2 kg) were used to compare three treatments: corn-soybean meal control (CTRL), CTRL diet for 63 d with Yield Pak (a blend of vitamins and trace minerals) added from 63 to 91 d (CTRL/YPC), or CTRL/YPC diet supplemented with 200 ppb Cr from chromium propionate from d 0 to 63 (Cr/YPC). Pigs (12 pens/treatment) were weighed on d 0, 63 and 91. Growth performance was similar across treatments (P > 0.10) from d 0 - 63. Day 63 to 91 gain (P < 0.05) and gain/feed (P < 0.01) steers at 108 d compared to d-62 concentrations. Cortisol was influenced by a supplement x implant interaction (P < 0.05). Supplemented EI steers had increased cortisol compared to supplemented LI steers (58.8 ± 6.6 vs 42.2 ± 6.4 ng/mL for LI and EI steers, respectively). Supplemented steers, independent of timing of implantation, had increased (P < 0.001) concentrations of IGF-I compared with non-supplemented steers (211.5 ± 19.9 vs 122.7 ± 11.8 ng/mL, respectively). Concentrations of T4 at d-0 were positively correlated (P < 0.05; r = 0.33) with ADG of steers. Management strategies may alter animal physiology, and those strategies should be considered when using physiological markers for the prediction or selection of animal growth.

Key Words: Steers, Thyroxine, Insulin-like Growth Factor-I

405 Performance effects of potassium and chloride levels in swine finisher diets. B. V. Lawrence*, J. D. Hahn, and S. A. Hansen, Hubbard Feeds Inc., Mankato, MN.

Two trials with terminal cross Duroc sired pigs were conducted to evaluate the effect of K or Cl levels in corn-soya-synthetic amino acid diets on growth and carcass parameters. In Exp 1, 512 pigs (38.7 ± 1.1 kg) were assigned to either a Control diet (0.22% Na, 0.41% Cl, and 0.73% K), or the Control diet supplemented with 0.10% (Low), 0.20% (Med), or 0.30% (High) K supplied as KCl. Constant Na and Cl levels were maintained by altering the level of dietary NaCl and NaPO4. Pigs (n = 6) were weighed on d-0, 21, 42, 63, and 85. In Exp 2, 512 pigs (32.9 ± 0.8 kg) were fed one of four diets. The Control diet was similar to that in Exp 1. The remaining 3 treatments were formulated to 0.94% K and 0.22% Na and either 0.60% (High Cl), 0.47% (Med Cl) or 0.33% (Low Cl) chloride. The Cl levels were achieved by altering inclusion level of NaPO4 and NaCl. Pigs (n = 6) were weighed on d-0, 21, 42, 63, 85 and 96. At the end of both experiments, real-time ultrasound (RTU) measurements of tenth rib loineye area (LEA) and backfat (TRF) as well as last rib fat (LRF) were obtained on 40 barrows and 40 gilts per treatment. Yield, fat depth, loin depth, and lean percentage were obtained on 40 barrows and 40 gilts per treatment at a commercial abattoir. Data was analyzed using the GLM procedures of SAS with pen the experimental unit for gain, intake and feed conversion and individual pig the experimental unit for RTU and abattoir analysis. During Exp. 1, pigs fed the K supplemented diets had numerically higher gains, however, there were no significant (P > 0.10) differences in gain, intake, or feed conversion. K supplementation had no influence on RTU or abattoir carcass parameters. In Exp. 2, pigs fed the Med Cl diets tended to have the highest (P <0.10) gain. There was no diet effect (P >0.10) on intake or feed conversion. RTU and abattoir carcass measurements were not different (P >0.10) across treatments. Yield was lowest (P <0.05) for the Low Cl fed pigs. These results suggest that K supplementation may improve growth, while the appropriate Cl level may influence gain and yield.

Key Words: Electrolytes, Growth, Pigs

Nonruminant Nutrition: Minerals

409 Performance effects of potassium and chloride levels in swine finisher diets. B. V. Lawrence*, J. D. Hahn, and S. A. Hansen, Hubbard Feeds Inc., Mankato, MN.

Two trials with terminal cross Duroc sired pigs were conducted to evaluate the effect of K or Cl levels in corn-soya-synthetic amino acid diets on growth and carcass parameters. In Exp 1, 512 pigs (38.7 ± 1.1 kg) were assigned to either a Control diet (0.22% Na, 0.41% Cl, and 0.73% K), or the Control diet supplemented with 0.10% (Low), 0.20% (Med), or 0.30% (High) K supplied as KCl. Constant Na and Cl levels were maintained by altering the level of dietary NaCl and NaPO4. Pigs (n = 6) were weighed on d-0, 21, 42, 63, and 85. In Exp 2, 512 pigs (32.9 ± 0.8 kg) were fed one of four diets. The Control diet was similar to that in Exp 1. The remaining 3 treatments were formulated to 0.94% K and 0.22% Na and either 0.60% (High Cl), 0.47% (Med Cl) or 0.33% (Low Cl) chloride. The Cl levels were achieved by altering inclusion level of NaPO4 and NaCl. Pigs (n = 6) were weighed on d-0, 21, 42, 63, 85 and 96. At the end of both experiments, real-time ultrasound (RTU) measurements of tenth rib loineye area (LEA) and backfat (TRF) as well as last rib fat (LRF) were obtained on 40 barrows and 40 gilts per treatment. Yield, fat depth, loin depth, and lean percentage were obtained on 40 barrows and 40 gilts per treatment at a commercial abattoir. Data was analyzed using the GLM procedures of SAS with pen the experimental unit for gain, intake and feed conversion and individual pig the experimental unit for RTU and abattoir analysis. During Exp. 1, pigs fed the K supplemented diets had numerically higher gains, however, there were no significant (P > 0.10) differences in gain, intake, or feed conversion. K supplementation had no influence on RTU or abattoir carcass parameters. In Exp. 2, pigs fed the Med Cl diets tended to have the highest (P <0.10) gain. There was no diet effect (P >0.10) on intake or feed conversion. RTU and abattoir carcass measurements were not different (P >0.10) across treatments. Yield was lowest (P <0.05) for the Low Cl fed pigs. These results suggest that K supplementation may improve growth, while the appropriate Cl level may influence gain and yield.

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