necessary for infection is needed to assess the likelihood of transmission by oral exposure in the field. This study was designed to estimate the probability that a specific oral dose of PRRS virus would result in infection. The experiment was conducted as a randomized block design in which individually housed 19 - 24 day old pigs were orally exposed to a specific dose (titer) of PRRS virus (2 to 7 logs $TCID_{50}$). Each replicate consisted of 10 animals: 4 treatment levels of PRRS virus (run in duplicate), plus positive and negative control animals. To test a volume effect, treatment doses were administered in either 10 ml or 100 ml volumes. Animals were bled on days -7, 0, 7, 14, 21 and serum samples tested for evidence of PRRS virus infection by virological and serological assays to determine whether exposure resulted in infection. The pig was considered the experimental unit. The primary outcome for this study is binary, i.e., pigs become infected or not. The resulting probabilities at each dose were used to construct and infectious dose curve using a single hit model based formula. The estimated infectious dose$_{50}$ (ID_{50}) of young healthy pigs is 10^5 $TCID_{50}$. However an oral treatment dose of 10^3 $TCID_{50}$ were sufficient to cause infection in young swine. No differences existed between antibody levels by route or dose of exposure.

Key Words: PRRS Virus, Swine, Oral

720   A deterministic risk assessment of macrolide use in swine. A. G Mathew*[1], H. S. Hurd[2], S. Doores[3], D. Hayes[4], J. Maurer[5], P. Silley[6], R. N. Jones[7], and R. Singer[8], [1]University of Tennessee, Knoxville, [2]Hurd-Health Consulting, Roland, IA, [3]Pennsylvania State University, University Park, [4]Iowa State University, Ames, [5]University of Georgia, Athens, [6]MB Consult Limited, Bingley, West Yorkshire, UK, [7]The JONES Group/JMI Laboratories, North Liberty, IA, [8]University of Minnesota, St. Paul.

To quantify risks stemming from antibiotic-resistant bacteria as a possible consequence of macrolide antibiotic use in swine, a farm-to-patient deterministic risk assessment was formulated using extensive scientific and government numerical data. The model was developed based on the US FDA Center for Veterinary Medicine Guidance Document 152, which advises veterinary drug sponsors of one potential process for conducting a qualitative risk assessment of drug use in food animals. The scope of modeling included all label claim uses of both antibiotics in U.S. swine production, including therapeutic, disease prevention, disease control, and growth promotion, as indicated by CVM-approved label claims for swine. The defined hazard was illness caused by a food-borne bacterium with a resistance genetic element(s), attributed to pork, and treated with a human-use macrolide drug. Risk was defined as the probability of this hazard combined with the consequence of treatment failure due to resistant *Campylobacter spp.* or *Enterococcus faecium.* A binomial fault tree model was applied to estimate this annual risk for the general US population. This risk assessment demonstrated that use of tylosin and tilmicosin in swine present a very low risk, with an approximate annual probability of less than 1 in 53 million *Campylobacter spp.*-derived and less than 1 in 27 billion *Enterococcus faecium*-derived risks.

Key Words: Macrolide, Antibiotic Resistance, Risk Assessment

Beef Species: Enhancing Energetic Efficiency

721   Growing program effects on efficiency of energy use by feedlot cattle. C. R. Krehbiel*, M. P. McCurdy, and G. W. Horn, *Oklahoma State University, Stillwater.*

Maintenance energy requirements can account for more than half of the ME intake by beef cattle. It is generally accepted that ADG and efficiency during finishing are directly related to plane of nutrition and energy density of the diet during the growing phase. Steers that are fed for high ADG during the growing phase accrete a greater percentage of their BW gain as fat than restricted steers, and contain more fat upon feedlot entry. Restricted steers have greater protein content as a percentage of BW, and are generally considered to have a lower NE$_g$ requirement. Cattle that have had greater rates of BW gain during the growing phase are generally assumed to be less efficient and have decreased gains during the finishing phase. This concept is consistent with the 1996 Beef Cattle NRC Level 1 Model, which shows a negative correlation between predicted ME allowable ADG and initial body fat content. In contrast, recent literature has reported that cattle subjected to greater ADG during the growing phase might not always experience lower ADG or gain efficiency during the finishing phase. Reasons for discrepancies are not fully understood. Changes in visceral organ mass might change the amount of nutrients available for growth. Several authors have observed that when ME intake was restricted, mass of the gastrointestinal tract (**GIT**) was similar or decreased compared with animals fed above maintenance or ad libitum. In contrast, ruminants restricted by energy density of the diet have greater GIT mass as a percentage of BW. The GIT appears to respond to physical form of the diet and fiber content, which could increase NE$_m$ requirements during finishing. Investigation into gain and efficiency of feedlot cattle must provide a complete picture of nutritional management through all production segments due to the number of potential factors that may determine performance in the feedlot. A comprehensive understanding of animal biology will allow us to enhance efficiency of beef production systems, and improve end-product quality.

Key Words: Cattle, Energetic Efficiency, Gastrointestinal Tract

722   Nutrition *in utero* and pre-weaning has long-term consequences for growth and size of Piedmontese- and Wagyu-sired steers. P. L. Greenwood*[1,2], H. Hearnshaw[1,3], L. M. Cafe[1,3], D. W. Hennessy[1,3], and G. S. Harper[1,4], [1]CRC for Cattle and Beef Quality, Armidale, NSW, Australia, [2]NSW Agriculture, Armidale, NSW, Australia, [3]NSW Agriculture, Grafton, NSW, Australia, [4]CSIRO Livestock Industries, St. Lucia, QLD, Australia.

Piedmontese (PxH) and Wagyu (WxH) x Hereford steers were selected for divergence in birth weight (PxH, Low mean±SEM 31.4±0.8 and High 42.1±0.9 kg; WxH, Low 27.4±0.7 and High 36.7±0.6 kg) and pre-weaning growth following high (irrigated improved temperate pastures) or low (sub-tropical native pastures) nutrition during pregnancy and either high or low nutrition from birth to weaning. Steers were weaned at 7 months of age and grown on improved temperate pastures, with supplementation as required to maintain growth, to 26 months of age when they entered a feedlot for 105 days prior to slaughter. Steers from dams nutritionally restricted during gestation and/or steers nutritionally restricted from birth to weaning had lower live and carcass weights compared to their high birth weight plus high pre-weaning nutrition (HH) counterparts at 30 months of age, this being most evident in the low birth weight plus low pre-weaning nutrition (LL) steers. These results support the notion that nutritional restriction early in life limits capacity to compensate when adequate nutriment is restored. However, retail yield on a carcass weight-specific basis was greater in the LL steers compared to their HH counterparts. This finding, and the lack of nutritional effects on indices of carcass fatness beyond those attributable to differences in body weight of these animals, does not support the notion that increased fatness later in life is a consequence of nutritional restriction early in life. We conclude that nutrition early in life has long-term consequences for growth and size of steers at any given age to 30 months.

Table. Performance of Piedmontese (PxH) and Wagyu (WxH) x Hereford steers with divergent birth weight and pre-weaning growth as a result of high or low nutrition *in utero* and pre-weaning (HH, LH, HL, LL).

	PxH	WxH	LSD	HH	HL	LH	LL	LSD	Effects
Number of animals	40	39	-	20	19	20	20	-	-
Pre-weaning ADG, g	735	729	46	950	582	864	533	63	N
Weaning live wt, kg	195	191	12	243	161	222	145	18	N
Weaning to feedlot entry ADG, g	619	601	23	602	629	580	629	32	G†,N
Feedlot entry live wt, kg	527	512	15	562	499	529	487	22	G†,N,GxN†
Feedlot ADG, g	1420	1295	75	1388	1375	1339	1329	107	G,GxN
Weaning to feedlot exit ADG, g	713	677	24	689	715	664	712	34	G,N
Live wt at feedlot exit, kg	673	645	20	705	641	667	623	28	G,N
Hot carcass wt, kg	385	362	12	400	363	380	350	17	G,N
Dress, % hot carcass wt	57.2	56.0	0.5	56.7	56.6	56.9	56.1	0.8	G
Carcass LMA, cm^2	87.8	82.5	3.5	83.9	85.0	87.8	84.0	4.8	G,W
Carcass fat, mm	15.8	20.8	2.9	19.4	17.4	19.5	17.0	4.1	G,W
USDA marbling score	386	536	32	450	460	455	479	45	G
Retail yield, % cold side weight	69.0	64.2	0.8	65.8	66.6	66.5	67.5	1.2	G,N

Treatment group values are unadjusted means.
Effects (P<0.05, †P<0.10) as determined by ANOVA where
G = genotype and N = nutrition, or ANCOVA for carcase
composition-related variables, where W = cold side wt covariate.

Key Words: Cattle, Nutrition, Growth

723   Effects of limit feeding on net nutrient flux and oxygen consumption by the portal-drained viscera.

M. P. McCurdy*, M. J. Hersom, C. R. Krehbiel, and G. W. Horn, *Oklahoma State University, Stillwater*.

Ten steers (average initial BW = 430 ± 42 kg) were used in a randomized complete block design over two observation periods. Steers were blocked by previous treatment (high or low BW gain while grazing winter wheat pasture) and allotted to two treatment groups in a switch-back design. The purpose of the experiment was to determine the effects of ad libitum feeding versus limit feeding on diet digestibility, visceral organ mass, blood flow, blood gas measurements, oxygen consumption, and net flux of metabolites across the portal-drained viscera (PDV) of finishing beef steers fed a high-concentrate diet. Treatments were ad libitum feeding of the diet (CON) or feeding at 90% of ad libitum (LF). Limit-fed steers consumed 86.5% and 87.8% of the actual DMI of CON steers during period 1 and 2, respectively. Limit-feeding increased DM ($P < 0.05$) and OM ($P < 0.05$) digestibility of the diet by 3.9% and 3.8%, respectively compared with CON steers, whereas N digestibility did not differ ($P = 0.21$) among treatments. The increase in digestibility resulted in similar (5.53 vs 5.22 ± 0.48 kg/d; $P = 0.46$) digestible OM intake among treatments. Net flux of α-amino N and urea N were not different among treatments. Concentrations of glucose in arterial and portal blood tended ($P = 0.06$) to be greater for CON steers; however, net portal removal of glucose tended ($P = 0.07$) to be greater in CON steers suggesting greater glucose utilization by the PDV. No significant differences were observed in blood gas measurements, and oxygen consumption by the PDV did not differ among treatments (-475 vs -437 mmol/h for CON and LF, respectively). After 34 d of limit-feeding, visceral organ mass did not differ among treatment groups. The increase in OM digestibility by LF steers suggests nutrient availability was similar among treatments. Combined with lower utilization of glucose and similar oxygen consumption by the PDV, our data suggests more efficient utilization of nutrients by limit-fed steers.

724   Effect of time of feeding a limit-fed high grain diet during winter months on growing feedlot steers.

S. M. Holt*, R. H. Pritchard, and J. A. Clapper, *South Dakota State University, Brookings*.

The effect of feeding time on physiological status and performance of steers in the winter was investigated during a 56-d feedlot growing study. Steers were limit-fed a high moisture ear corn diet (2.04 Mcal/kg NE$_m$, 1.39 Mcal/kg NE$_g$) at 0900h (AM) or 1500h (PM) to allow for gain of 1.40 kg/d. Calculations of NE$_g$ intake were derived using NRC equations and tabular values for dietary ingredients. Climatic data were collected

hourly throughout the study via an automated weather station located at the feedlot. Tympanic temperatures (TT) were collected every 15 minutes (3 steers/treatment) for 6d (d45 to 50) during the final 14 d period. Serum free T$_3$ and T$_4$ concentrations were determined from blood samples (18 steers/treatment) collected on d44 and d51. Ambient temperature (T$_a$) during the 56 d growing study ranged from -21.4 to 13.2° C with a mean of -5.7° C. During the 6 d TT collection period, mean T$_a$ was -2.0° C and ranged from -19.2 to 0.4° C. Initial BW was 298 ± 5kg. Body weight after 56d growing period (393kg vs 401kg), ADG (1.70 vs 1.84kg) and gain efficiency (231 vs 250 g/kg) differed (P<.05) between AM and PM groups, respectively. Serum free T$_3$ and T$_4$ levels were similar for both treatment groups. Mean TT were similar (39.4 vs 38.9° C; P > 0.10) between AM and PM groups, respectively. No changes in diurnal TT patterns were observed. Minimum TT during the 6d collection period tended to be higher for the AM compared to the PM group (38.9 vs 38.4° C; P = 0.09), respectively. Maximum TT were higher for AM than PM (40.0 vs 39.4° C; P<.05). Based upon performance, maintenance energy expenditure was increased 25.1% for the AM group (P < 0.05). T$_3$ and T$_4$ levels were unable to explain this difference. It is possible that when offering feed in the morning compared to the afternoon, basal metabolic rate has to be increased to maintain body temperature. The TT data suggest animals may overestimate energy requirement and increase body temperature above normal levels, resulting in reduced performance.

Key Words: Tympanic Temperature, Steers, Feedlot

725   Residual feed intake: an alternative measure of feed efficiency for beef cattle.

Gordon E. Carstens*[1] and M. S. Kerley[2], [1] *Texas A&M University, College Station*, [2] *University of Missouri, Columbia*.

Feed inputs represent more than 60% of the cost of producing beef, and manure outputs are the primary contributor to the industry's adverse effect on the environment. Thus, feed efficiency is an important trait to consider developing selection programs to identify cattle that are more economically and environmentally sustainable to produce. Considerable genetic variation is known to exist in feed efficiency, but the expense of measuring feed intake has precluded the implementation of selection programs that target this trait. Moreover, the traditional measure of feed efficiency (feed:gain ratio; F:G) is known to be inversely related to growth and mature size, such that selection for improved F:G leads to increases in cow size. Recent developments provide opportunities to improve the genetic merit of cattle for feed efficiency: (1) emerging commercialization of new technologies to more cost effectively measure feed intake in cattle and (2) discovery of an alternative measure of feed efficiency (residual feed intake; RFI) that will facilitate selection of more efficient cattle with minimal effects on growth traits or cow mature size. RFI is calculated as the difference between an animal's actual feed intake and the feed an animal is expected to consume based on its weight and growth rate–cattle that eat less than expected for their weight and growth will have a negative RFI or improved net feed efficiency. RFI has been shown to be moderately heritable and genetically independent of growth and mature size in cattle. Multidisciplinary research is needed to determine the biological basis for variation in RFI, and to examine the effects of selection for RFI on reproductive efficiency, carcass composition and meat quality. Discovery of management practices, genetic markers, and physiological (e.g., IGF-1) or physical (e.g., exit velocity, feeding behavior) traits that are predictive of RFI would be useful to more accurately and cost-effectively identify animals with superior genetics for RFI. Increasing genetic merit for RFI has potential to reduce production costs, mitigate environmental effects of producing beef and increase the competitive position of the beef industry.

Key Words: Residual Feed Intake, Efficiency, Beef Cattle

726   Correlations among ultrasound carcass estimates, growth performance measures, and residual feed intake in Angus steers.

J. I. Szasz*, C. W. Hunt, S. D. Baker, T. Klein, P. S. Kuber, B. Glaze, D. Falk, R. Richard, J. Miller, R. A. Battaglia, and R. A. Hill, *University of Idaho, Moscow*.

Residual feed intake (RFI) has received increasing attention as an alternative measure of gain efficiency (GEF; gain per DMI) in beef cattle. The objectives of the current study were to evaluate RFI in purebred Angus steers using novel linear regression equations and to define correlation coefficients between attributes of growth, ultrasound measures

and RFI. Steers (n = 54; mean BW 341 kg) were individually fed (electronic feeding gates) a forage-based growing diet for 70 d. Daily DMI, biweekly BW, initial (d 0) and final (d 70) ultrasound estimates of 12th rib fat thickness (BF), longissimus muscle area (REA), and intramuscular fat percent (IM) were determined. In addition to RFI computations reported in previous literature (DMI = $\beta 1$*ADG + $\beta 2$*metabolic BW), DMI was regressed against ADG, metabolic BW (MBW), and ultrasound measurements using stepwise regression techniques. Ultrasound measurements were included as well as their MBW-adjusted counterparts. The adjusted model included effects due to ADG, MBW, and final BF (R2 = 0.71; RMSE = 0.51) resulting in a minor improvement over the original equation (R2 = 0.68; RMSE = 0.53). Measures of BW, ADG, final REA, and IM were not (P > 0.90) correlated with RFI, whereas, RFI was correlated (P < 0.05) with DMI (r = 0.56), GEF (r = -0.44), and final BF (r = 0.28). In addition, GEF was correlated (P < 0.01) with initial BW (r = -0.46), ADG (r = 0.65), DMI (r = -0.40), and initial REA (r = -0.64). Range in RFI was -1.12 to + 1.52 kg DMI, and both models indicated that low RFI steers (RFI < 0.5 SD below the mean) had lesser (P < 0.02) DMI than high RFI steers (RFI > 0.5 SD above the mean) and that high RFI steers had lesser (P < 0.01) GEF than low RFI steers. When the conventional model was used, final BF was lowest (P < 0.001) for low RFI steers. These data are consistent with previous studies where low RFI steers appear to be slightly leaner.

Key Words: Beef Cattle, Gain Efficiency

727   Relationship of feeding behavior to feed efficiency in crossbred Angus steers. J. W. Golden* and M. S. Kerley, *University of Missouri–Columbia.*

A study was conducted to determine the relationship between feed efficiency and feeding behavior of feedlot steers. The hypothesis was that high and low efficiency steers would not differ in feeding behavior. Crossbred Angus steers (n = 80) were fed ad libitum and individual feed intakes were recorded by the GrowSafe® feed intake system. Recorded intakes were used to calculate residual feed intake (RFI), a measure of efficiency. RFI values were calculated three consecutive months, and animals were identified as efficient (n = 6) or inefficient (n =6). Average RFI values for the efficient (-1.564) and inefficient (1.657) groups differed (P < 0.01). Data from these 12 animals were analyzed. Starting and ending weights did not differ (P > 0.10) between groups. Average daily intake (7.94 kg vs. 11.70 kg) and average eating bouts per day (10.99 vs. 18.15 visits) differed (P < 0.01), with efficient animals consuming less feed and eating fewer times per day. Grams eaten/minute (97.9 vs. 94.7) did not differ (P > 0.10) between high and low efficiency groups. Average daily gain for the efficient and inefficient animals (1.40 vs. 1.50 kg/day) did not differ (P > 0.10). The feed to gain ratio differed (P < 0.01) between groups. Time of day eating bouts occurred was divided into eight periods (1,2,3,4,5,6,7 and 8). Each period was 3 hours in length with period 1 occurring from 12-3a.m., and each remaining period following consecutively in 3 hour time blocks. The amount of feed consumed differed (P < 0.05) in periods 3,4,5,6 and 7 when comparing groups. Periods 4,5 and 6 represented the periods when most feed consumption occurred. In the high efficiency group the amount consumed between periods 4,5 and 6 did not differ (P > 0.10). However, in the low efficiency group the amount of feed consumed in periods 4,5 and 6 differed (P < 0.05). The differences in consumption between periods in the low efficiency group and the lack of difference in the high efficiency groups cannot be fully explained. Further study is warranted to determine if a link exists between eating patterns and efficiency status of an animal.

Key Words: RFI, Eating Behavior

728   The effect of mitochondrial uncoupling proteins 2 and 3 on feed efficiency in crossbreed angus steers. W. H. Kolath*, M. S. Kerley, and J. W. Golden, *University of Missouri-Columbia.*

The objective of this study was to determine if a relationship exists between uncoupling proteins 2 and 3 (UCP 2&3) and feed efficiency. Inefficient animals would hypothetically be expected to have greater expression of UCPs than efficient animals. Crossbreed Angus steers (n=80), fed at ad libitum, had their individual feed intake recorded via the Growsafe® feed intake system over a three-month period. Intakes were used to calculate residual feed intake (RFI), a measure of efficiency. Tissue samples were taken from the *longissimus lumborum* muscle from

both the most (RFI -1.564; n = 6) and least (RFI 1.657; n = 6) efficient animals. Tissue samples were immediately frozen in liquid nitrogen and stored at -80[0]C until further analysis. Total RNA was extracted and reverse transcribed to cDNA. Uncoupling protein 2&3 cDNA was measured by quantitative real-time polymerase chain reaction. Protein was also extracted from the tissue samples and fractionated on 10% SDS-Page gels, blotted to PVDF membranes and probed with antibodies against UCP 2&3. No difference in either cDNA expression or protein expression was observed. Mitochondrial uncoupling proteins 2 and 3 are therefore believed to be unrelated to feed efficiency.

Key Words: Mitochondria, Uncoupling Protein, Feed Efficiency

729   Variation in energy expenditures between growing steers with divergent residual feed intakes. Monte B White*, Gordon E Carstens, Casey M Theis, Michael W Kurz, Ching-Yi Chen, Lisa J Slay, and Tom H Welsh Jr., *Texas A&M University, College Station.*

Residual feed intake (RFI) is a measure of feed efficiency that quantifies variation in feed intake beyond that needed for maintenance and growth requirements. For this study, steers with the lowest (low; n = 9) and highest (high; n = 9) RFI were selected from 169 Braunvieh-sired crossbred steers that were individually fed a pelleted roughage-based diet (calculated metabolizable energy; ME = 2.2 Mcal/kg DM) for 77 d using Calan feeders. RFI was calculated as the difference in actual DMI and DMI predicted from the regression of DMI on mid-test BW$^{.75}$ and ADG. Objectives of this study were to determine if variation in energy expenditures contributed to differences in feed efficiency between low and high RFI steers. Following the 77-d RFI period, steers were fed the same diet while being halter broken and adapted to respiration chambers. Steers were fed at 1.1X maintenance for 4 d and heat production (MHP) measured for two consecutive 22-h periods using indirect calorimetry. HP was measured on d 3 and 4 of fasting (FHP) and metabolizable energy for maintenance (ME$_m$) calculated using linear regression of ME intake on retained energy. Heart rate (HR) and motion activity were measured concurrently with HP. During the 77-d RFI period, low RFI steers had lower (P < .001) RFI (-1.7 vs 1.6 ± .17 kg/d), DMI (7.7 vs 10.2 ± .42 kg/d) and feed:gain ratio (F:G; 7.2 vs 10.6 ± .60), but similar final BW (331.5 ± 10.2 kg) and ADG (1.1 ± .07 kg/d). However, during the 112-d calorimetry phase, there were less differences in DMI (8.4 vs 9.7 ± .38 kg/d; P = .02) and F:G (9.7 vs 10.8 ± .40; P = .07) between low and high RFI steers. No differences were found in FHP (98.5 vs 102.1 ± 3.1 kcal/kg$^{.75}$/d) or ME$_m$ (148.4 vs 151.0 ± 4.1 kcal/kg$^{.75}$/d) between low and high RFI steers. Likewise, no differences were found in HR, respiratory quotients or motion activities during FHP and MHP measurements. The lack of differences in FHP and ME$_m$ between divergent RFI steers may have been the result of alterations in feeding behavior or activity imposed by adapting steers to calorimetry chambers.

Key Words: Residual feed intake, energy expenditure, cattle

730   Effects of Revalor®-200 vs. Finaplix®-H in single and reimplant strategies for yearling heifers. C. D. Reinhardt[1], W. T. Nichols*[1], J. P. Hutcheson[1], S. Swingle[2], and K. Karr[2], [1]*Intervet, Inc., Millsboro, DE,* [2]*Cactus Research, Ltd, Amarillo, TX.*

One thousand eight hundred eighty-five English×continental yearling heifers (309 kg) were used in a randomized complete block study to evaluate the effects of Finaplix-H and Revalor-200 in single or reimplant strategies. Heifers were blocked by arrival date and assigned to one of four treatments: 1)Finaplix-H (200 mg trenbolone acetate (TBA)) on d0 (FH); 2)Revalor-200 (20 mg estradiol 17β (E$_2$) + 200 mg TBA) on d0 (R200); 3)Revalor-IH (8 mg E$_2$ + 80 mg TBA) on d0 and Finaplix-H on d60 (IHFH); 4)Revalor-IH on d0 and Revalor-200 on d60 (IH200). There were 5 pens per treatment with an average of 94 head per pen. Heifers were harvested after 137 days on feed. The R200 heifers had higher ADG (P = 0.08) and tended to have improved feed:gain (P = 0.11) on a carcass-adjusted basis than the FH heifers. The FH heifers had higher marbling score and higher percent Prime+Choice than any other treatment (P < 0.01), but they also had higher yield grade, calculated empty body fat (EBF), and lighter predicted live weight at 28% EBF than either the R200 or IH200 heifers (P < 0.05), indicating that they finished sooner and lighter than the R200 and IH200 heifers. The IH200 heifers had lower DMI than any other treatment (P < 0.05), characterized by a

marked and sustained reduction in DMI following the reimplant event. Due to the lower DMI, the IH200 heifers had lighter final weight and lower ADG on a live basis (P<.01) than the IHFH heifers, but these differences were reduced on a carcass-adjusted basis. The IH200 heifers had significantly improved feed conversion compared to FH and R200 (P = 0.01) and tended to have better feed conversion than IHFH (P = 0.14) on a carcass-adjusted basis. The IH200 heifers had significantly higher dressing percent, less rib fat, larger ribeye area, lower average yield grade, greater percentage yield grade 1 & 2, lower EBF, and heavier predicted weight at 28% EBF than any other treatment (P < 0.01). These data indicate that Revalor-200 may improve performance and EBF-adjusted final weight compared to Finaplix-H in either single or reimplant strategies utilized in yearling heifers.

Carcass-adjusted[1] Performance and Carcass data

Item	FH	R200	IHFH	IH200
DMI, kg	7.97[a]	7.99[a]	7.92[a]	7.68[b]
ADG, kg	1.39[a]	1.42[b]	1.44[b]	1.41[ab]
F:G	5.73[a]	5.62[ab]	5.52[bc]	5.45[c]
Pr+Ch,%	55.1[a]	37.3[b]	42.1[b]	36.4[b]
YG	2.6[a]	2.4[b]	2.6[ab]	2.1[c]
EBF, %	28.4[a]	27.6[b]	28.1[a]	26.9[c]
AFBW[2], kg	505[a]	518[b]	516[b]	532[c]

[1]Adjusted for common dressing percent.
[2]Final live weight adjusted to 28% EBF; [a,b,c]differ (P<.05)

Key Words: Anabolic Implants, Feedlot, Heifer

Breeding and Genetics: Dairy Genetic Evaluation

731   International genetic evaluation of longevity traits. J. H. Jakobsen* and U. Emanuelson, *Interbull Centre, Uppsala, Sweden.*

The first test run for international genetic evaluation of longevity traits took place in March 2004 and was performed for the Holstein breed. The test run is an outcome of preliminary research studies, which showed feasibility of international genetic evaluation for longevity traits. The 14 countries participating in the research studies defined longevity either as risk of involuntary culling, length of productive life, or survived as a 0-1 trait. Traits were analyzed nationally with linear mixed models and survival analysis. International genetic evaluations were performed using Multitrait Across Country Evaluation (MACE), and correlations between countries ranged in the research study from zero to 0.92, and were on average 0.59. Two different traits have been defined within the longevity trait group. These are longevity as a direct trait and longevity as a trait combined with indicator traits. Combined longevity is a complex trait in the sense that the choice of indicator traits is very variable across countries. Also, procedures to calculate weighting factors for the deregressed national combined proofs, as input to MACE, is unresolved. The first official test run was therefore performed for direct longevity only, but research is currently going on to investigate such unresolved issues for combined longevity. Research is also ongoing to investigate feasibility of international evaluation for longevity for other breeds than Holsteins. The presentation will focus on correlations between countries and selection differentials from the March test run for direct longevity.

Key Words: MACE, longevity

732   Correlated traits used for indirect prediction of productive life in Holsteins. S. Tsuruta*[1], I. Misztal[1], and T. J. Lawlor[2], [1]*University of Georgia, Athens,* [2]*Holstein Association USA Inc., Brattleboro, VT.*

The purpose of this study was to update formulas used for indirect prediction of productive life from correlated traits. Productive life was defined as days in milk at age 84 mo within the limit of 305 DIM for each lactation. Genetic parameters for 25 traits (productive life, milk, fat, protein, somatic cell score, days open, 18 linear type, and final score) were estimated with a multiple-trait sire model via Gibbs sampling. The data contained 392,800 records for Holstein cows born from 1995 to 1997. The model included registration status, herd-year, age group, month of calving and stage of lactation as fixed effects, and random sire genetic effects and residual effects. Heritability for productive life was estimated as 0.09. Genetic correlations of productive life with milk, fat, protein, somatic cell score, days open and final score were 0.11, 0.11, 0.12, 0.32, 0.62 and 0.13, respectively. Stronger correlations with linear type traits were 0.37 for udder depth, 0.29 for body depth, 0.27 for fore attachment, and 0.25 for dairy form. Using all of the 24 traits, productive life can be predicted with the maximum reliability of 0.69. Using five traits (in order of declining importance: days open, udder depth, milk, stature and somatic cell score), the maximum reliability was 0.61. Compared to currently used correlations for indirect prediction, many correlations changed sign, indicating changes in definition of productive life and that many conformation traits have intermediate optima. Days open became the most correlated trait with productive life.

Key Words: Genetic correlation, Productive life, Holstein

733   Analysis of the relationship between type traits and functional survival in Canadian Jersey cows. A. Sewalem*[1,2], G. Kistemaker[2], and B. Van Doormaal[2], [1]*Agriculture and Agri-Food Canada,* [2]*Canadian Dairy Network.*

The aim of this study was to explore the impact of type traits on the functional survival of Canadian Jersey cows using a Weibull proportional hazard model using the Survival Kit. The data set consisted of 49,791 cows from 900 herds calving from 1985 to 2003. Functional survival was defined as the number of days from the first calving to culling or death or censoring. Type information consisted of phenotypic type scores of 8 composite traits and 20 linear descriptive traits. The statistical model included the effects of stage of lactation, season of production, the annual change in herd size, type of milk recording supervision, age at first calving, effects of milk, fat and protein yields calculated within herd-year-parity deviations, herd-year-season of calving, one type trait and the sire. Analysis was done one at a time for each of 30 type traits. The relative culling rate was calculated for animals in each class after accounting for the above-mentioned effects. Among the composite type traits with the greatest contribution to the likelihood function were final score, mammary system, fore udder, rear udder and dairy character, all having a strong relationship with functional survival. Cows with low scores (i.e., classified as Poor) for these traits had higher risk of culling ranging 2 to 5 times compared to higher scores (i.e., classified as Excellent). Linear type traits with the greatest contribution to the likelihood function were style, fore attachment, udder texture and udder depth. Rump angle and set of rear legs had no strong relationship with functional survival compared to other linear type traits.

Key Words: Functional Survival, Jersey, Type Trait

734   Potential of three-stage selection strategies for enhancing the efficiency of progeny testing programs in US dairy cattle. K. Weigel* and N. Zwald, *Department of Dairy Science, University of Wisconsin, Madison.*

The focus of dairy cattle improvement programs has evolved from single-trait selection for milk yield to multiple-trait selection for production, type, and various measures of health, fertility, longevity, and calving performance. In the US, national genetic evaluations for productive life (PL), somatic cell score (SCS), daughter calving ease (DCE), and daughter pregnancy rate (DPR) have all been implemented in the past decade. However, the reliabilities (REL) of predicted transmitting abilities (PTA) for these "functional" traits are low for many important bulls, because heritability parameters for these traits are =10% and because progeny groups for first-crop artificial insemination (AI) sires in the US typically contain only 60-80 daughters. This can lead to errors in selection of sires of sons. For example, 18 of the top 50 Holstein bulls for Lifetime Net Merit (LNM) $in February 2002 ranked below the 80th percentile for LNM$ in February 2004, long before their sons had completed progeny testing. Our objective was to evaluate the potential for a "third stage" of selection among elite AI sires at 84-90 mo of age (in addition to pedigree selection at 0-6 mo of age and first-crop progeny selection at 48-54 mo of age) resulting from the distribution of additional semen for the top 50% of "sires in waiting" (based on updated parent averages) at 30-36 mo of age. Because service sire calving ease data are typically available