SCFA production was numerically greater only for those pigs fed diets containing GOS. The diet containing SS resulted in greater production of SCFA than the TOS diet. In conclusion, dietary addition of GOS to pig diets resulted in greater concentrations of beneficial bacteria and only a small decrease in nutrient digestibility.

Key Words: Digestibility, Bacteria, Fermentation

159   Botanicals for nursery pigs. P.J. Holden* and J.D. McKean, *Iowa State University, Ames, IA.*

The historical use of botanicals to treat or prevent infectious diseases has been supplanted with relatively low cost, effective and available synthetic antimicrobial products. Selected herbs possess natural antimicrobial activity and other characteristics useful in value-added animal protein production and their inclusion in animal feeds as alternative growth promotion and efficiency stimulating strategies may address antibiotic resistance concerns while producing a more holistically grown pork product. Echinacea, garlic, goldenseal and peppermint were evaluated with pigs weaned at 18 d and 6.25 kg. Pigs were allotted to 1.2 x 1.2 m raised-deck pens at random by litter and initial weight. Each pen received 16 kg of prestarter treatment per pig and starter treatment diets for the remainder of the 5-wk study. The positive diet contained 45 ppm of Mecadox. Botanical treatments consisted of the same diet without Mecadox and botanicals replaced corn, with the 0% level considered a negative control. Pigs were weighed and feed disappearance measured weekly. ADG, ADF and F/G were analyzed using the GLM procedure of SAS with the pen as the experimental unit. **Echinacea** (0 to 3%) was the most efficacious botanical evaluated. In the first three weeks pigs fed additions of 2 or 3% Echinacea had ADG and F/G similar to Mecadox controls and improved over the negative control. **Garlic**(0 to 5%) was evaluated in two trials. High garlic levels reduced performance primarily by depressing feed intake. Feeding any garlic depressed performance compared to Mecadox. Garlic also flavored the meat of harvested animals. **Goldenseal** (0 to 1.0%) was not statistically efficacious in one trial and was poorer than Mecadox controls. **Peppermint** (0 to 5%) was not a statistically efficacious in nursery diets when evaluated over two trials. Additions generally were no better than the negative control and sometimes statistically depressed performance. More information at www.extension.iastate.edu/ipic/reports/00swinereports/Nutrition00.html

Key Words: Swine, Botanical, Nursery

160   Plant extracts enhance sow lactation performance. S. E. Ilsley[1], H. M. Miller[1], H. M. R. Greathead[1], and C. Kamel*[2], [1]*University of Leeds, Leeds, UK,* [2]*AXISS France SAS, Archamps, France.*

Many plant extracts promote health and growth. This study aimed to evaluate their ability to stimulate piglet and sow performance when supplemented in the diets of lactating sows. Three extracts were tested: Yucca Shidigera, Quillaja Saponaria and Combination (a blend of capsicum, cinnamaldehyde and carvacrol). Eighty sows (25% Large White, 50% Landrace, 25% Duroc) of mixed parity were housed in conventional indoor farrowing crates from d107 of gestation to weaning. Sows were allocated according to parity, liveweight, fatness and past performance, to one of 4 dietary treatments: Control (CTR), Combination (COM, 100 ppm), Yucca (Y, 200 ppm), Quillaja (Q, 250 ppm). Diets were otherwise identical, containing 3,333 kcal DE/kg and 1.0% total lysine. From d107-114 of gestation, sows received 2.5 kg feed/d. In lactation

sows were fed *ad-libitum* with FI recorded daily. Piglet liveweight and sow P2 backfat were recorded on d1, 7, 14, 21 and at weaning on d23 2.5. Data, corrected for litter size and birth weight, were analysed using the GLM procedure of Minitab 12.2. Piglet growth between birth and d1 was better for COM sows. (117 g vs CTR 99 g, Q 77 g, Y 107 g; P < 0.01, SEM = 7.9). Similarly, between d15-21, piglets of COM sows outperformed all other treatments (COM 290 g/d, CTR 246 g/d, Q 235 g/d, Y 255 g/d; P < 0.001, SEM = 9.3). Piglet weights on d21 were also greater for COM sows (6878 g vs CTR 6584 g, Q 6330 g, Y 6498 g; P < 0.05 SEM = 132). Sow FI and P2 backfat loss were unaffected by treatment. Improved growth rates in the first 24h suggest facilitation of lactogenesis or enhanced piglet vigor at birth. The improved piglet weight gains of COM sows from d15-21 suggest enhanced milk yield at a time when it normally limits piglet growth. As sow FI and backfat loss remained unchanged, this indicates greater efficiency in feed utilisation for milk production. Alternatively, or additionally, piglets may have been utilising the milk with greater efficiency resulting in enhanced growth.

Key Words: Sows, Plant extracts, Lactation

161   Plant extracts enhance broiler performance. D. Jamroz[1] and C. Kamel*[2], [1]*The Agricultural University of Wroclaw, Poland,* [2]*AXISS France SAS, Archamps, France.*

Many plant extracts reportedly improve animal performance and well-being. This study evaluated their effects on live performance parameters and carcass characteristics at slaughter in commercial broilers. A commercial feed formulation based on ground wheat, barley, and soybean meal containing a coccidiostat and an enzyme with 0.5% chromic oxide as an indigestible marker served as the control diet. Four treatments were compared: control diet without additive (negative control), control diet with Avilamycin (10 ppm; positive control), and XT (a blend of capsicum, cinnamaldehyde and carvacrol) at 150 and 300 ppm. 1,120 broilers were housed in conventional indoor floor pens from day 1 to 48 and allocated to 1 of 4 dietary treatments: Control (CTR), XT150 (XT, 150ppm), XT300 (XT, 300ppm), and Avilamycin (AV, 10ppm). Diets were otherwise identical, containing a metabolizable energy content of 12.5MJ/kg. The trial was run over two periods: 1-21 days and 22-48 days. Broilers were fed *ad libitum* with FI recorded daily. Broiler liveweight was recorded on d1, 21, and 48. Mortality was recorded daily. Concurrently, a digestibility trial was run in 420 broilers for apparent ileal nutrient digestibility coefficients and gut flora characterization. Raw data means were analyzed by STATISTICA PL ver. 5.1 (1997). Broilers on the XT diets between d1 and 17 had significantly better daily weight gains (XT300 625g vs XT150 608g, AV 605g, CTR 578g P<0.001) and feed conversion ratios (XT300 1.44 vs XT150 1.49, AV 1.47, CTR 1.56, P<0.05). Similarly XT broilers showed greater liveweights at d48, and at slaughter higher percentages of breast muscle. Digestibility studies performed at d21 showed that XT broilers significantly digested fiber, fat, ash, and nitrogenous substances better. In addition, XT broilers showed lower caecal counts for *E. coli*and *C. perfringens*. This study illustrates that plant extracts fed to commercial broilers give similar live performance levels as the antibiotic growth promoter Avilamycin. These benefits may be due to the greater efficiency in the utilization of feed, resulting in enhanced growth. The improved digestibility leads to a more balanced gut flora, with the potential to reduce shedding of pathogenic bacteria (i.e. *E. coli* and *C. perfringens*) into the environment.

Key Words: Plant extracts, Broilers, Gut flora

Production, Management, and the Environment
Dairy Management

162   Nutritionally induced growth pattern changes of pregnant heifers and subsequent changes in body weights and dry matter intake. H. C. Freetly*, C. L. Ferrell, and T. G. Jenkins, *USDA, ARS, U.S. Meat Animal Research Center.*

The objective of this study was to determine the effect of altering the amount of feed provided at different periods of pregnancy and lactation on the efficiency of feed utilization for calf production. MARC III heifers (n=128) were individually fed a corn silage-based ration (2.39 Mcal ME/kg DM). Heifers were allocated to three treatments that varied

in the timing that dry matter was offered. Dry matter intakes from 94 through 186 d of gestation were M-M-M-M 674±4 kg, L-H-M-M 521±5 kg, and L-L-L-H 523±5 kg. Dry matter intakes from 187 d of gestation to parturition were M-M-M-M 817±9 kg, L-H-M-M 938±12 kg, and L-L-L-H 679±8 kg. Dry matter intakes from parturition through 27 d postpartum were M-M-M-M 260±4 kg, L-H-M-M 264±3 kg, and L-L-L-H 220±3 kg. Dry matter intakes from 28 through 66 d postpartum were M-M-M-M 385±5 kg, L-H-M-M 377±6 kg, and L-L-L-H 528±10 kg. At 187 d of gestation, BW of L-H-M-M (n=40; 448±6 kg) and L-L-L-H heifers (n=43; 447±6 kg) did not differ (*P*=0.83), but was less

than M-M-M-M heifers ($P<0.001$; n=45; 478±5 kg). At parturition, BW of M-M-M-M (472±5 kg) and L-H-M-M heifers (466±5 kg) did not differ ($P=0.43$), but was greater than L-L-L-H heifers ($P<0.001$; 436±5 kg). Birth weight of M-M-M-M (31.6±0.6 kg) and L-H-M-M calves (31.8±0.8 kg) did not differ ($P=0.91$), but was greater than L-L-L-H calves ($P<0.001$; 28.3±0.6 kg). Twenty-eight days postpartum, BW of M-M-M-M (n=43; 470±5 kg) and L-H-M-M heifers (n=40; 463±5 kg) did not differ ($P=0.35$), but was greater than the L-L-L-H heifers ($P<0.001$; n=42; 432±5 kg). At 28 d of age, BW of M-M-M-M (56±1 kg) and L-H-M-M calves (57±1 kg) did not differ ($P=0.49$), but was greater than L-L-L-H (P<0.001; 50±1 kg). At 66.2±0.3 d postpartum (n=124), BW of heifers ($P=0.51$; 461±3 kg) and calves ($P=0.29$; 80±1 kg) did not differ among treatments. We interpret these results to suggest that altering patterns of nutrient supply can be used as a viable management tool for decreasing feed cost.

Key Words: Heifers, Pregnancy, Growth

163   Effects of raising regime on milk yield of primiparous holstein cows.   L. A. Torbert*[1], J. G. Linn[1], D. G. Johnson[2], G. J. Cuomo[2], H. Chester-Jones[3], and M. L. Raeth-Knight[1], [1]*University of Minnesota, St. Paul, MN,* [2]*West Central Research and Outreach Center, Morris, MN,* [3]*Southern Research and Outreach Center, Waseca, MN.*

Raising heifers on pasture is an alternative to traditional confinement systems. There is limited research investigating the effects of raising system during growth on lactation performance. The objective of this study was to compare first lactation performance of heifers raised on pasture versus in confined feedlot pens from 18 to 22 months of age. In May 2000, 63 pregnant heifers were allocated among 3 treatments: continuous grazing (C), rotational grazing (R), or feedlot/confinement (F). Heifers in F were fed alfalfa haylage with corn to achieve a similar average daily gain as heifers on pasture. Heifers remained on their management treatment until 4 weeks prior to calving, when they were moved to a tie stall barn. Following calving, all cows received the same diet: (dry matter basis): 39% corn silage, 12% chopped alfalfa hay, 16% ground corn, and 33% supplement. Of the original 21 heifers assigned to each treatment, 3 C, 2 R, and 6 F cows did not complete 250 days of lactation and were removed from the study. In addition, displaced abomasums (DA) occurred in 3 C, 2 R, and 7 F cows. There were no differences found (p>0.05) in body weight (BW), body condition score (BCS), milk production, or milk composition across raising management treatments. Dry matter intake (DMI) was significantly different (p<0.03) across treatment with R cows consuming more dry matter per day than F cows. Milk production was numerically highest for R cows, but not different (p>0.05) than C or F cows.

	Continuous	Rotational	Feedlot	P-value
N, through 250 days	16	17	11	
DMI, kg/d	19.6[ab]	20.5[b]	18.3[a]	0.025
BW, kg	536.9	526.8	539.6	0.758
BCS	2.9	2.9	3.1	0.285
Milk, kg/d	30.1	33.3	31.2	0.192
Fat, kg/d	1.0	1.1	1.0	0.514
Protein, kg/d	0.9	1.0	0.9	0.217
Lactose, kg/d	1.5	1.6	1.6	0.300
DA, % of assigned (21)	14.3	9.5	33.3	

Key Words: Dairy heifers, Lactation performance, Management

164   Economic analysis of high yielding dairy cows under different feeding systems combining pasture, total mixed ration and concentrates.   P. R. Tozer*[1], F. Bargo[1], and L. D. Muller[1], [1]*Pennsylvania State University.*

The objective of this research was to utilize partial budgeting to compare the net income of high yielding Holstein cows managed under 3 different feeding systems including total mixed ration (TMR), pasture-based diets, or a combination of both. The variables considered in the analysis were milk income, and feed, feeding, fencing and water system expenses (revenues and costs were based on 2000 values). The potential economic advantage of the combination of pasture with TMR compared to a typical TMR under non-grazing is the reduction in feed costs with the inclusion of pasture in the diet. Forty-five Holstein cows (109 DIM) were assigned to one of three dietary treatments: TMR, non-grazing;

pasture plus TMR (pTMR); and pasture plus concentrate (PC). Cows on the TMR were fed a nutritionally balanced TMR ad libitum. Cows on the PC received pasture as the sole forage in a rotational grazing system plus 1 kg concentrate/4 kg milk. Cows on the pTMR grazed with the PC cows between the a.m. and p.m. milking and were housed overnight and fed 17 kg DM/d of TMR. Cows on TMR yielded the highest net income per cow per day ($6.00) even though the expenses exceeded the other two treatments ($3.92). The higher net income was due to higher yields of milk (38.1 kg/d) and milk components (1.24 kg/d fat, 1.13 kg/d true protein). Cows on the PC had the lowest daily net income ($5.04) principally due to lower yields of milk (28.5 kg/d) and milk components (0.89 kg/d fat, 0.79 kg/d true protein) even though the expenses were also the lowest ($2.69). Cows fed the pTMR yielded higher daily net income per cow ($5.14) than the PC cows and lower than the TMR cows (32.0 kg/d milk, 1.06 kg/d fat, 0.93 kg/d true protein). Providing high producing cows with additional nutrients with a pTMR, can increase the profitability of dairy grazing systems compared to a feeding system of pasture and concentrate.

Key Words: Grazing, Economics, Feeding systems

165   Application of mixed model methodology to the determination of the economic optimal pre-pubertal rate of gain of dairy heifers.   N. R. St-Pierre*, *The Ohio State University, Columbus.*

A recent report concluded that the economic optimal pre-pubertal (PP) rate of gain of dairy heifers is less than 700 g/d. The authors, however, used ordinary least-squares (OLS) to model observations from three independent studies. We have shown that OLS yields biased parameter estimates when used on unbalanced data typical of multi-experiment summaries (meta-analyses), whereas estimates obtained with mixed model methods are free of bias under the assumption of a correct functional form. The objective of this research was to estimate the optimal PP rate of gain using mixed model methods, while appropriately accounting for first lactation feed costs and time discounts in the economic analysis. Study A involved 273 animals assigned to three PP treatments with average daily gains (ADG) of 680, 830, and 940 g/d. Study B used 68 animals assigned to four treatments (two involved an implant) with PP-ADG of 705 and 1,009 g/d. Study C used 105 heifers assigned to 3 treatments (one involving bST) resulting in PP-ADG of 770 and 1,120 g/d. The OLS regression of first lactation milk yield (kg/305 d; MY) on PP-ADG resulted in the following linear equation (SE of estimate in parentheses): MY = 11,763 (1,564) # 3.422 (1.781) * PP-ADG (RMSE=715.6). The slope had an overall P=0.11 of being different from zero. A mixed model with the fixed effects of PP-ADG, an overall intercept, and random effects of Study and interaction of Study*PP-ADG was fitted with the observations weighed according to the reciprocals of the SEM[2] to account for the unequal variances of observations across studies. The random interaction was not significant and was removed in the final model. The overall (across study) regression was: MY = 10,493 (539) # 2.085 (0.379) * PP-ADG (RMSE=0.51). The overall slope had a P=0.01 of being different from zero. Estimates of random effects were: Study A, 831.8 (427.5); Study B, -385.4 (431.35); and Study C, -446.4 (433.5). Thus, when properly analyzed by a mixed model, the data suggest a far lower reduction in first lactation production from increased PP-ADG than OLS. Using this relationship with estimated market costs of nutrients and a 5% time discount rate, the optimal PP-ADG ranges between 800 and 900 g/d.

Key Words: Pre-pubertal Growth, Mixed Models, Economic Optimum

166   Feeding neonatal calves milk replacers (MR) with different protein, fat, and lactose levels.   T. M. Hill*, J. M. Aldrich, A. J. Proeschel, and R. L. Schlotterbeck, *Akey.*

Two trials (48 calves each) were conducted to evaluate how varying CP levels, source of fat, fat levels, and lactose levels of a MR fed at 454 g daily would affect calf growth. In both trials, bull calves (42 kg, less than 1 week old) were randomly assigned to MR treatments and fed fixed amounts of MR (all milk CP plus synthetic lysine and methionine) with free-choice starter for 6 weeks. Calves were fed starter alone after 6 weeks. Fresh water was offered free-choice at all times. Calves were weighed initially and weekly. Starter intake, fecal scores, and medical treatments were recorded daily. Data by trial were analyzed as a completely randomized design with means separated using Student Newman Keuls test. Average initial serum protein levels of calves did not differ

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(P > .1) among treatments for either trial. In trial 1, three MR were fed. The fat source was a blend of animal fat, vegetable fat, and specific fatty acids. The lactose level was fixed at 40% by limiting the whey and using a corn-derived carbohydrate. The lysine and methionine levels of all MR were formulated to be equal by using milk protein and synthetic amino acids. The three MR were A) 20% CP, 20% fat, B) 20% CP, 15% fat, and C) 18% CP, 15% fat. There were no differences (P > .1) in gains, starter intake, hip width changes, body condition score changes, medical treatments, and scour scores among treatments. In trial 2, MR A and C from trial 1, plus MR D (20% CP, 20% fat) and E (20% CP, 15% fat) formulated with milk proteins, no amino acids, no corn-derived carbohydrate, and edible lard as the fat source, were tested. From 0-6 weeks, MR A and C supported faster (P < .05) gains than MR D and E. Starter intake was lowest (P < .05) for calves fed MR D. There were no differences (P > .1) in any measurement between 6 and 8 weeks of age. These data suggest that MR should be formulated with consideration to amino acids, fatty acids, and carbohydrate sources rather than crude protein and crude fat.

Key Words: Milk Replacer, Calves, Nutrients

167   Effect of sprinkling frequency and airflow on respiration rate, skin temperature and body temperature of heat stressed dairy cattle. M.J. Brouk*, J.F. Smith, and J.P. Harner, III, *Kansas State University*.

Sixteen heat stressed lactating cows (8 primiparous and 8 multiparous) were arranged in a replicated 8x8 Latin Square design to evaluate the effect of sprinkling frequency and airflow on respiration rate, skin temperature and body temperature. Cattle were housed in freestall dairy barns and milked 2x. During testing, cattle were moved to a tie-stall barn for a 2-hour period from either 1-3 pm or 3-5 pm on 8 different days in late August and early September. During the testing period, respiration rates were determined every five min by visual evaluation. Skin temperature of three sites was measured with an infrared thermometer and recorded every 5 min. Body temperature was continuously recorded every minute throughout the testing period utilizing a data logger and vaginal probe. Treatments were 4 different wetting frequencies with and without supplemental airflow. Wetting frequencies were control, every 5 min, every 10 or every 15 min. Supplemental airflow was either none or 19.8 cm/min. Each single wetting cycle within each treatment utilized similar amounts of water. Initial data were collected for three initial 5-min periods prior to the start of the treatments. Average respiration rates were higher (P<.05) 101.0 vs 72.6 breaths/min for controls as compared to cows treated with wetting cycles every 5 min in addition to supplemental airflow. Cows wetted every 5 min with supplemental airflow responded with the fastest (P<.05) and greater (P<.05) drop in respiration rate reducing the initial respiration rate by 50% at the end of 90 min of treatment. Wetting had a greater (P<.05) effect on respiration rate than airflow. However, the combination of wetting and airflow had the greatest (P<.05) effect on respiration rate. When cooling heat stressed dairy cattle, the most effective treatment included continuous supplemental airflow and wetting every 5 min.

Key Words: Heat Abatement, Heat Stress, Environmental Modification

168   Effect of utilizing evaporative cooling in tie-stall dairy barns equipped with tunnel ventilation on respiration rates and body temperature of lactating dairy cattle. M. J. Brouk*, J. F. Smith, and J. P. Harner, III, *Kansas State University*.

During the summer of 2001, six tie-stall dairy barns in northeast Missouri were monitored to determine the effects of evaporative cooling on the environment, respiration rate and body temperature of lactating dairy cattle housed in barns equipped with tunnel ventilation. Temperature and relative humidity were continuously monitored and recorded every 15 minutes in six barns (3 with and 3 without evaporative cooling systems) using data loggers for a three-month period. Temperature and relative humidity data were averaged by hour prior to statistical analysis. Respiration rate, infrared skin temperature and rectal body temperature of 20 animals per barn (10 primiparous and 10 multiparous) were measured on three different days during summer heat stress. Measurements were taken between 7-8 am, 4-5 pm and 10-11 pm on each of the three days. Cattle housed in evaporative cooled tunnel ventilated barns had lower (P<.05) afternoon and evening respiration rates and body temperatures than those housed in barns without evaporative

cooling. Evaporative cooling reduced (P<.05) afternoon barn temperatures, however relative humidity increased (P<.05) as compared to barns with only tunnel ventilation. Evaporative cooling in conjunction with tunnel ventilation reduced afternoon heat stress of dairy cattle housed in tie-stall barns. High environmental relative humidity reduced the cooling capacity of the evaporative cooling, however on the days of animal observation it reduced heat stress of lactating dairy cattle.

Key Words: Heat Abatement, Heat Stress, Environmental Modification

169   Non-dietary sources of variation of milk urea nitrogen (MUN) in Ohio dairy herds. P.J. Rajala-Schultz*[1], [1]*The Ohio State University*.

The purpose of this study was to describe non-dietary sources of variation and factors associated with MUN in Ohio dairy herds. The data came from 24 herds, 1681 cows and 12,939 test days. Half of the herds were classified as low producing herds (rolling herd average (RHA) milk production ≤ 7,258 kg) and half as high producing herds (RHA milk production ≥ 10,433 kg). MUN was measured from the monthly DHI test day milk samples spectrophotometrically by an automated procedure with a Skalar Segmented Flow Analyzer. The data were analyzed using multilevel modeling technique in MLwiN®, separately for both production groups. Different levels of organization were herd, cow, and test day. Initially, a simple random intercept model containing only a constant was run. Explanatory variables previously identified being associated with MUN were then added to the model as fixed effects. The unadjusted mean MUN in high producing herds was 13.9 and 11.3 mg/dl in low producing herds. Variation in MUN was greater in low than in high producing herds. Also, the variance structure was different between these groups. In low producing herds, 67.2% of the variation in MUN was at test day level, only 0.2% at cow level and 32.6% at herd level. In high producing herds, however, highest proportion of the variance (49.0%) was found at herd level, 12.1% at cow level and 38.9% of the variation was at test day level. With significant independent variables in the model, the proportion of variation explained at herd level increased. MUN concentration was lower during the first month of lactation than later in the lactation. Also, season of the test day was associated with MUN (highest levels in spring and summer). Cow#s test day milk production and fat-protein ratio in milk were positively associated with MUN levels in high producing herds. The observed differences in the proportions of variance at different levels between the production groups may be explained by management factors. Lower variability in MUN between test days in high producing herds indicates more consistent day-to-day feeding and management within herds in this group.

Key Words: Milk urea nitrogen, Variation, Multilevel modelling

170   The effects of prepartum milking on postpartum reproductive performance in dairy heifers. S. Bowers*[1], S. Gandy[1], K. Graves[1], S. Eicher[2], K. Scott[2], M. Schutz[3], and S. Willard[1], [1]*Mississippi State University, Mississippi State, MS*, [2]*USDA-ARS, West Lafayette, IN*, [3]*Purdue University, West Lafayette, IN*.

The prepartum milking of dairy heifers may be beneficial to postpartum production performance through the acclimation of heifers to the milking parlor. The objective of this study was to determine if the prepartum milking of dairy heifers would improve postpartum reproductive health, as determined by rates of uterine involution, ovarian follicular development and the resumption of estrous cycles. Pregnant Holstein heifers (Holstein, n = 21, Jersey, n = 10) were assigned to either a prepartum milked (pre-milked; n = 15) or control (n = 16) treatment group. Pre-milked heifers were milked twice-daily starting three weeks prior to anticipated calving dates, while control heifers did not enter the parlor until after calving. Following calving, measurements were taken twice weekly to assess reproductive health and included palpation for uterine tone (1 = poor, 5 = excellent) and uterine position (0 = below pelvic rim; 2 = above pelvic rim / normal position), vaginal electrical conductance (VEC; relative units: RU) measurements, and the quantification of follicular development and cross-sectional area of the uterine horns (uterine difference) by transrectal ultrasonography. Blood serum samples were collected for progesterone (P_4) analysis and quantified by RIA. Uterine tone, uterine position and uterine difference did not differ (P > .10) relative to treatment, but changed over time (P < .0001) postpartum. VEC increased (P < .0001) from week 2 (73.1 ± 1.9 RU) to week 9 (94.2 ± 2.2 RU) postpartum, but also did not differ (P > .10) relative

to treatment. Pre-milked heifers tended (P < .08; 2.5 ± .24) to have more large follicles at 30 d post-partum relative to controls (1.8 ± .26), while numbers of small- and medium-sized follicles did not differ (P > .10) between treatment groups. Initiation of luteal activity (i.e., day in which two consecutive P_4 samples were > 1 ng/ml) did not differ (P > .10) between control (25.9 ± 2.5 d) and pre-milked (33.1 ± 3.5 d) heifers. In summary, with the exception of follicular numbers on selected days, no overt differences in reproductive parameters were observed between the pre-milked and control heifers.

Key Words: Pre-milking, Uterine involution, Heifers

171   Dry matter intake prediction equation for non-lactating Jersey cows in late gestation and breed dry matter intake differences in late gestation. P. D. French*[1], H. H. Meyer[1], R. E. James[2], and J. K. Drackley[3], [1]*Oregon State University,* [2]*Virginia Tech,* [3]*University of Illinois.*

An equation for predicting prepartum DMI of Jersey cows was developed using data from 54 multiparous Jerseys involved in testing seven diets at three universities. Dietary concentrations of CP and NDF ranged from 12 to 15% and 35 to 40%, respectively. An exponential equation, similar to that in NRC (2001), was used to describe prepartum DMI. The equation was DMI (% of BW) = a + be$^{(kt)}$, where a is asymptotic intercept at time infinity, b is the magnitude of decline in DMI, be$^{(kt)}$ is the shape of the curve, and t is day prepartum. The following equation for predicting DMI during the final 21 d of gestation was generated using the NLIN procedure of SAS: DMI (% of BW) = 2.34 - 0.60e$^{-0.16t}$. The prediction equation was evaluated using 15 multiparous Jersey cows. The prediction equation underpredicted DMI by 0.16% of BW and bias was greater near parturition. The two data sets were combined to generate the following equation for predicting DMI during the final 21 d of gestation: DMI (% of BW) = 2.35 - 0.53e$^{-0.16t}$. Data from 54 nonlactating multiparious Holstein and Jersey cows in late gestation involved in testing three diets were analyzed using the MIXED procedure of SAS to determine if DMI differs between breeds. Dry matter intake as a % of BW was greater for Jerseys ($P < 0.01$). The decline in DMI of Holstein cows as parturition approached was greater compared to that of Jerseys (breed by day interaction, $P < 0.01$). Exponential equations were developed for each breed and differences between breeds for a, b, and k were tested using the t-test. Coefficients for a, b, and k were 2.08, -0.99, and -0.19 for Holsteins and 2.37, -0.50, and -0.08 for Jerseys. Coefficients a and k were similar for Holsteins and Jerseys. However, coefficient b was less ($P < 0.05$) for Holsteins, indicating greater DMI depression compared to Jerseys. The DMI prediction equation and recognition that breed differences exist will aid in prepartum ration formulation.

Key Words: Dry matter intake, Prepartum, Jersey

172   The effects of prepartum milking on postpartum production performance in dairy heifers. S. Bowers*[1], S. Gandy[1], K. Graves[1], S. Eicher[2], K. Scott[2], M. Schutz[3], and S. Willard[1], [1]*Mississippi State University, Mississippi State, MS,* [2]*USDA-ARS, West Lafayette, IN,* [3]*Purdue University, West Lafayette, IN.*

The acclimation of heifers to the milking parlor via prepartum milking may be beneficial to heifer postpartum production performance, and has been shown previously to improve postpartum heifer udder health (e.g., reduced udder edema). The objective of this study was to determine the impact of prepartum milking on postpartum milk production and associated performance characteristics in dairy heifers. Pregnant heifers (Holstein, n = 21, Jersey, n = 10) were assigned to either a prepartum milked (pre-milked; n = 15) or control (n = 16) treatment group. Pre-milked heifers were milked twice-daily starting three weeks prior to anticipated calving dates, and milk production recorded at each milking. All heifers were evaluated on day 21, 14, and 7 before calving, and twice weekly after calving through 60 days postpartum. On these days, body weight (BW), body condition score (BCS), udder edema scores (0 = no edema apparent, 10 = severe edema) and milk conductivity readings were recorded. Milk production from pre-milked heifers increased (P < .01) from 2.3 ± .62 kg at three weeks prior to calving to 10.1 ± .95 kg within 1 week of calving and did not differ (P > .10) between breeds. Post-calving milk production was higher (P < .0001) for Holstein than Jersey heifers, but did not differ (P > .10) by treatment within breed. While BW and BCS did not change pre-calving within breed relative to treatment (P > .10), post-calving BW and BCS were decreased (P < .05). Overall through week six postpartum pre-milked

heifers had lower (P < .01) udder edema scores than control heifers (1.9 ± .22 and 3.0 ± .26, respectively), and through week five had lower (P < .0001) milk conductivity readings (indicative of fewer incidences of udder infections) than control heifers. In summary while udder health was improved post-calving in pre-milked heifers compared to controls, other production performance characteristics (e.g., milk production, BW and BCS) remained unaffected.

Key Words: Pre-milking, Milk production, Heifers

173   Effects of feeding low phytic acid corn and phytase on phosphorus balance in lactating dairy cows. B.E. Hill*[1], S.L. Hankins[1], J.F. Kearney[1], J.D. Arseneau[1], D.T. Kelly[1], S.S. Donkin[1], B.T. Richert[1], and A.L. Sutton[1], *Purdue University, W. Lafayette, Indiana.*

Effects of feeding low phytic acid corn and phytase on phosphorus balance in lactating dairy cows
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An experiment was conducted with mid-lactation Holstein cows (n=32; av. parity=2.5) to evaluate nutrient excretion and production traits when cows were fed low phytic acid corn (LPA) and phytase. Cows were stratified by previous milk production, parity, and days in lactation and fed a common diet two weeks prior to treatment initiation. Dietary treatments were fed for two weeks before sample collection. Cows were fed diets formulated to meet or exceed current NRC (1989) requirements for all nutrients and contained .38% P. Diets consisted of low phytic acid corn (LPA), or control corn (NC) with or without phytase (127 g/d) in a 2 x 2 factorial arrangement of treatments. Feed intake and milk production were determined daily, fecal grab samples were obtained on four consecutive days each week to form two weekly composites for fecal analysis. Feed marked with ytterbium was added to the ration at 40 mg/kg DM to determine apparent nutrient digestibility. Milk samples were collected on 4 consecutive milkings during fecal sampling periods and pooled for analysis. Blood serum was obtained weekly for P analysis. Cows across all diets had similar overall milk production (av. 30.1 kg/d), milk composition and DMI (av. 21.5 kg/d). Cows fed LPA diets tended to have a higher overall fecal DM (18.55% vs. 17.74%; P<.02) than those fed NC diets. Cows across all treatments had similar fecal ammonium-N, TKN, and serum P. Cows fed LPA diets had significantly less fecal P concentrations (5667.5 vs. 6300.6 ppm; P<.03) than those fed NC diets, with no effect of phytase on fecal P. Cows fed LPA and LPA+PHY had significantly lower concentrations of fecal water-soluble P (2478.47 and 2495.65 vs. 3107.61 and 3129.27 ppm; P<.0001) than cows fed NC and NC+PHY, respectively. This level of phytase supplementation had no effect on P utilization in the lactating dairy cow. This study demonstrates that low phytic acid corn hybrids have the potential to improve P utilization and reduce both water-soluble and total P excreted in the feces in lactating dairy cows.

Key Words: Phosphorus, Nutrient Excretion, Dairy Cows

174   Effects of voluntary wait and censoring assumptions on life table analysis of reproductive data. DT Galligan[1], JF Ferguson*[1], G Azzaro[2], S Ventura[2], J Brooks[2], and G Licitra[3], [1]*University of Pennsylvania,* [2]*Consorzio Ricerca Filiera Lattiero Casearia,* [3]*Universit di Catania.*

This project used SAS life table analysis to evaluate the influence of voluntary wait and censoring assumptions on timed event analysis (survival analysis) of dairy reproductive data. Time event analysis has become the method of choice in the evaluation of dairy reproductive data both in research studies as well as on the farm. This method evaluates the number of cows experiencing the event of interest (pregnancy) against those eligible for a given time period of interest (21 d. period) and determines a hazard rate (pregnancy rate = proportion of cows experiencing the event over the time interval of interest). Assumptions about the initiation of the period of eligibility (voluntary wait) influenced summary hazard rates by reducing their values when earlier voluntary wait periods were assumed. Assumptions about the censoring of cows were also evaluated where censoring was assumed to occur: 1) at the beginning of each risk period (the current approach used in several computer herd record system), 2) the middle of the risk period (the current approach in SAS life table analysis) and 3) at the end of the period. Assuming that censoring occurred at the beginning of each risk period dramatically inflated the summary pregnancy rate, while censoring at the end

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of each period decreased the summary rate. The end censoring assumption more closely approximated the rates calculated from mid interval censoring. Bias introduced by the timing of the censoring assumption (beginning or ending of an interval) cumulate over intervals when one is calculating a summary hazard.

175 Effect of elapsed time between initial thawing of multiple 0.5-mL semen straws and AI on conception rates in dairy cattle.

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To facilitate the AI of numerous cows in a timely manner, AI technicians routinely thaw multiple semen straws simultaneously. The objective of this study was to determine the effect of elapsed time between initial thawing of multiple 0.5 mL semen straws and AI on conception rates in dairy cattle. Eight dairies (located in ID, WA, CA and OH), 4 with professional AI technicians (PAI) and 4 with herdsman-inseminators (HI) participated in the study. Initial data recorded included beginning thaw time, cow identification number, and time of AI. Herd records were retrieved following pregnancy diagnosis. The average elapsed time from initial thaw to first, second, third, and fourth AI (N=884) was 6.2 ± 0.2, 7.8 ± 0.2, 9.3 ± 0.3, 11 0.3 minutes, respectively. The average time from initial thaw to completion of fourth AI was similar for PAI and HI. Conception rates for first, second, third, and fourth straws for PAI were: 46%, 44%, 34%, 42%, respectively. Conception rates for first, second, third, and fourth straws for HI were: 24%, 20%, 33%, 30%, respectively. Within PAI and HI, neither straw number nor elapsed time affected conception rate. However, average conception rate of straws (1 to 4) differed between PAI and HI (P < 0.01; 42 vs. 27%, respectively). Although the average conception rate differed between PAI and HI, elapsed time and straw number had no effect on conception rate

within inseminator group. Therefore, PAI and HI may thaw four straws simultaneously without compromising conception rates.

176 Factors affecting prepartum dry matter intake of pregnant nonlactating Holstein and Jersey cows in late gestation.

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An experiment was conducted using 15 multiparious Holstein and 15 multiparious Jersey cows to determine if DMI and plasma parameters differed between breeds. Cows were blocked by expected calving date and received a TMR beginning 30 d prior to expected calving date. The TMR contained (dry matter basis) 35% corn silage, 21% oat hay, 16% alfalfa hay, 18% ground corn grain, 7% soybean meal, and 3% mineral-vitamin premix. Diet dry matter concentrations of crude protein and NDF were 14% and 35%, respectively. Blood samples were collected at 21, 14, 11, 9, 7, 5, 3, 2, 1 d prior to expected calving date and on two consecutive days following parturition. Plasma was analyzed for β-hydroxybutyrate, glucose, growth hormone, and NEFA. Data were analyzed using the MIXED procedure of SAS to determine if differences exist between Holsteins and Jerseys. Mean DMI the last 21 d of gestation was 13.9 kg/d for Holsteins and 11.0 kg/d for Jerseys. The magnitude of decline in DMI as parturition approached was greater for Holsteins (breed by day interaction; $P < 0.01$). Dry matter intake declined 39% for Holsteins and 24% for Jerseys the day prior to parturition compared to 21 d prior to parturition. Plasma NEFA was greater ($P < 0.01$) for Holsteins (439±27 mM) compared to that of Jerseys (323±27 mM). Glucose (60.5±0.6 mg/dl for Holsteins and 60.5±0.7 mg/dl for Jerseys), β-hydroxybutyrate (6.48±0.19 mg/dl for Holsteins and 6.61±0.20 mg/dl for Jerseys), and growth hormone (4.43±1.02 ng/ml for Holsteins and 4.78±1.03 ng/ml for Jerseys) did not differ between breeds. This experiment confirms previous reports that the decline in DMI is less for Jerseys compared to that of Holsteins. Future investigations are necessary to determine the cause and effect relationship between breed differences in DMI depression and NEFA.

Ruminant Nutrition
Feedlot

177 Effect of source of energy and rate of gain on performance, carcass characteristics, ruminal fermentation, and glucose and insulin profiles of early-weaned steers.

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Seventy-three crossbred steers (initial BW 170.5 ± 5.5 kg) from The Ohio State University (experiment 1) and 216 crossbred steers (initial BW 135.4 ± 4.4 kg) from the University of Illinois (experiment 2) were used to determine the effect of source of energy and rate of gain on performance, carcass characteristics, and glucose and insulin profiles in early-weaned steers. Cattle were weaned at an average age of 119 d in both experiments, and allotted by age, weight, and breed to one of 4 diets: high-concentrate, fed ad libitum (**ALC**), high concentrate, fed to achieve a gain of either 1.2 kg/d (**1.2C**) or 0.8 kg/d (**0.8C**), or high-fiber, fed ad libitum (**ALF**). At 218 d of age all steers were placed on the high concentrate diet and fed ad libitum until slaughter. Steers were implanted with Compudose at the initiation of both experiments, and with Revalor-S when cattle were estimated to be 100 d from slaughter. When steers in experiment 1 averaged 181 and 279 d of age, serum samples were collected to determine glucose and insulin concentrations on 10 steers per treatment. Steers were slaughtered when a terminal fat thickness of 1.27 cm was reached (experiment 1) or after 273 d on feed (experiment 2). *Experiment 1*: Days in the feedlot (P<0.01) and age at slaughter (P<0.01) were lowest for ALC and ALF steers, intermediate for 1.2C steers, and greatest for 0.8C steers. ALC steers gained the fastest from 119 d of age until slaughter, followed by ALF and 1.2C; 0.8C steers gained the slowest (P<0.01). Final weight was low (504 kg), but did not differ (P>0.57) among treatments. At 181 d of age, insulin was elevated (P<0.10), and at 218 d of age, ALC had a higher percentage (P<0.07) of intramuscular fat, as measured by ultrasound, compared to cattle on the other diets. *Experiment 2*: ADG from 119 d of age until

slaughter (P<0.06) and final body weight (P<0.04) were greatest for ALC and lowest for 1.2C and 0.8C; ALF were intermediate, and did not differ from ALC or 1.2C and 0.8C. Growing phase diet did not affect subsequent marbling score at 218 d of age or at slaughter (P>0.81). Controlling growth by limit feeding a high concentrate diet for only 100 d does not extend the growth curve, or enhance intramuscular fat deposition at slaughter compared to ad libitum intake of a high concentrate or high fiber diet, respectively.

178 Beef cattle can successfully be fed 80% potato waste in the finishing diet.

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One hundred finishing beef steers were used to assess the effect of level of potato waste in the diet on feed intake, rate of gain, feed conversion efficiency, carcass grade and size, and meat quality, texture, color and sensory characteristics. Potato waste was comprised of potato steam peel, cull french fries and steamed cull potatoes, with proportions varying over the feeding period. Potato waste had on average 18% DM, 9.7% CP and 52.2% starch. Cattle were backgrounded for 90 d at a rate of gain of 1.2 kg/d before being assigned to one of five treatments. All rations comprised of 20% grass silage and 80% concentrate. Treatments were formulated by altering the proportion of potato waste to barley in the concentrate, with potato waste included at 0, 25, 50, 75, and 100% of the concentrate. Two pens, each of 10 animals, were assigned to each ration, which was fed for either 79, 107, or 135 d. Increasing the proportion of potato waste in the diet had few effects on any parameters measured, indicating that even very high levels of potato waste can be successfully fed to finishing cattle. Rate of gain showed a quadratic response (P<0.05) to potato waste inclusion, being higher (1.7 kg/d) for the 50% inclusion rate than for 0 or 100% inclusion rates (1.5 kg/). Dry

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