

for 1-M treatment (25 vs. 20 quails). It is concluded, that allocation of one male and three females per cage, is a better management system than placing two males and six females in the cage.

Key Words: Japanese quail breeders, population size

1093 Multiple-objective programming to reduce ration cost and nutrient excretion. P.R. Tozer* and J.R. Stokes, *The Pennsylvania State University, University Park, PA.*

Typical dairy rations are formulated to meet the nutrient requirements of the cow at the least cost. This approach is single objective oriented, and that is to minimize cost. In this paper we examine the use of multiple objective programming to formulate rations that minimize cost, and minimize phosphorus and nitrogen excretion. A ration formulation model was developed using the National Research Council's recommendations for nutrient requirements, and functions for protein intake and digestion, a phosphorus excretion function, and a set of prices of representative feeds for the northeastern United States. A "standard" cow was used in the model, this cow weighed 600kg, produced 30 kg of milk per day with a fat content of 3.5 per cent and was gaining 300 g per day. The cost of the minimum cost ration was \$2.81 per day and consisted

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1094 Feeding neonatal calves high levels of milk replacers (MR) with different protein and fat levels. T. M. Hill*, J. M. Aldrich, A. J. Proeschel, and R. L. Schlotterbeck, *Akey, Inc., Lewisburg, OH.*

Recent research with neonatal calves not receiving starters has suggested that feeding MR at high levels (over .6 kg daily) and with a high crude protein (CP) content (26 # 30%) will result in more efficient and faster gains. However, trials with a 20% CP MR fed at .57 vs. .45 kg daily observed no differences in gains because of reductions in starter feed intake with increased MR fed. We conducted a series of trials to examine how feeding rate and level of CP and fat in MR affect calf performance. In all trials, bull calves 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. Calves were weighed initially and weekly. Starter intake was measured and fecal scores and medical treatments recorded daily. In all trials, a 20% CP, 20% fat MR fed at .45 kg daily served as a control treatment. Average initial body weights were 40 to 42 kg. Feeding a 28% CP, 20% fat MR stepped-up to 1.13 or 1.36 kg daily resulted in no increase in gains, increased ($P < .1$) fecal scores and medical treatments, and reduced ($P < .1$) starter feed intake by 7 weeks of age compared to the control. Feeding a 28% CP, 20% fat MR at .68 kg daily increased gains, medical treatments, and fecal scores, but decreased starter intake vs. the control ($P < .1$). When .68 kg daily of a 13% fat MR was fed with CP levels from 20 to 28%, gains increased ($P < .1$) in a quadratic manner (optimum of 26%) and starter intake was no different from the control. When .68 kg daily of a 24% CP MR was fed with fat levels between 11 and 17%, gains increased ($P < .1$) linearly and starter intake was no different from the control. These results indicate that MR fed should be limited (to near .68 kg daily) so not to depress starter intake and that the CP (optimum near 26%) and fat (optimum near 17%) levels critically impact performance.

Key Words: Protein, Fat, Calves

1095 Feeding neonatal calves milk replacers (MR) containing egg proteins. T. M. Hill*, J. M. Aldrich, A. J. Proeschel, and R. L. Schlotterbeck, *Akey, Inc., Lewisburg, OH.*

Alternative crude protein (CP) to milk CP interest the calf raising industry because of the high price of milk CP. Soy CP sources are popular because of their low cost relative to milk CP sources but, depending upon the type and level included in a milk replacer, performance can be compromised. Our objectives were to 1) evaluate how calf performance is affected by the level of milk CP replacement with egg CP, 2) compare two whole egg sources, and 3) combine egg, soy protein concentrate (SPC), and milk proteins in MR. In each trial, 50 bull calves were randomly assigned to MR treatments and .45 kg of MR was fed with free-choice starter for 6 weeks. Calves were fed starter alone after 6 weeks.

principally of alfalfa hay, straw, dry distillers grain, bakery product and dry shelled corn. The ration contained less than 100g of mineral supplements. The "standard" cow excreted 279 g/day of nitrogen and 32.1 g/day of phosphorus. Rations were also formulated to minimize nitrogen and phosphorus. The results of the three single objective models were combined into a multiple-objective programming model to minimize the maximum deviation from the goals generated in the single objective models. The multiple objective models resulted in marginal reductions in nitrogen and phosphorus excretion. The most marked change in ration formulations occurred when the efficiency of phosphorus utilization was increased. The base ration contained an unacceptably large proportion of straw and no corn silage, hence other multiple objective rations were formulated to reduce the straw and increase the corn silage contents. These rations increased the costs of the ration by 0.05 - 0.35 per day and marginally increased the level of nitrogen and phosphorus excreted. Another result of this ration formulation research is that all rations formulated contained less than 100 g/day of mineral supplements, indicating that the use of these supplements is a costly expense and any amount of supplement fed over those formulated leads to excretion of excess nutrients.

Key Words: Ration formulation, nutrient management, mathematical programming

Calves were weighed initially and weekly. Starter intake was measured daily. Fecal scores and medical treatments were recorded daily. In all trials, a 20% CP (from milk protein) and 20% fat MR served as a control treatment. The egg CP source was used to replace a percentage of the total protein in the MR. Average initial body weights were 41 to 43 kg. In two trials, 10, 20, and 30% egg CP from source A and 20% egg CP from source B replaced whey CP. Increasing egg CP from source A resulted in a quadratic response ($P < .1$) of gain and starter intake with 30% being inferior to other lower levels of egg and the control. The 20% egg CP from source B supported lower ($P < .1$) gains and starter intakes than the control. Additionally, three trials were conducted to compare 15% egg CP from source A, 15% SPC CP, and 70% milk CP in a MR to the control MR. There were no differences in gains and starter intake. Fecal scores and medical treatments were not different from the control when egg CP from source A was used alone or combined with SPC. Egg CP can be used successfully as a partial replacement for whey CP in calf MR, but source of egg CP differs.

Key Words: Protein, Egg, Calves

1096 Protein levels for neonatal calf starters. T. M. Hill*, J. M. Aldrich, A. J. Proeschel, and R. L. Schlotterbeck, *Akey, Inc., Lewisburg, OH.*

Previous research has suggested that approximately 18% crude protein (CP; as-fed basis) is adequate for neonatal calf starters, however, some feed companies and universities have suggested that higher levels of CP may be required. To investigate CP requirements for calf starters we fed calves starters that contained graded levels of CP along with either a 20% CP (all milk CP plus synthetic lysine and methionine), 20% fat milk replacer at .45 kg daily (trial 1) or a 26% CP (all milk CP plus synthetic lysine and methionine), 17% fat milk replacer at .68 kg daily (trial 2). In each trial, 50 bull calves were randomly assigned to starter protein levels of 18, 20, 22, 24, and 26% as-fed basis (88% DM) and fed milk replacers and free-choice starter for 6 weeks. Calves were fed starter alone after 6 weeks. The starters were a corn-based pellet with 15% wheat midds and a fixed protein blend replacing corn with elevated levels of CP. The protein blend consisted of 75% soybean meal (48% CP), distiller's grains, blood meal, corn gluten meal, and fish meal. Mineral and vitamins levels were equal among starters. Calves were weighed initially and weekly. Starter intake was measured daily. Fecal scores and medical treatments were recorded daily. Hip widths and body condition scores was measured initially and every two weeks. Data were analyzed as a completely randomized design with linear, quadratic, and cubic contrasts relative to level of protein in the starters. Average initial body weights were 40 and 41 kg. In both trials, there were no differences ($P > .1$) in any measurement taken. These results indicate that neonatal calves fed 20% CP, 20% fat milk replacers at .45 kg daily and

26% CP, 17% fat milk replacers at .68 kg daily do not require starters with protein levels exceeding 18% CP (as-fed basis).

Key Words: Protein, Calves

1097 Behaviour and meat quality of veal calves receiving solid feeds for welfare purpose. G. Cozzi^{*1}, F. Gottardo¹, S. Mattiello², E. Canali², G. M. Burato¹, S. Segato¹, and I. Andrighetto¹, ¹University of Padova, Italy, ²University of Milano, Italy.

Behaviour, growth performance, carcass and meat quality of veal calves fed a traditional milk replacer diet (C) were compared to those obtained from calves fed the same diet plus 250 g/head/d of dried beet pulp (BP) or wheat straw (WS). The study lasted 160 d and used 138 Polish Friesian calves which were assigned to the 3 dietary treatments according to their initial BW. In comparison to C, calves fed WS diet reduced the frequency of abnormal oral behaviors throughout the fattening period. The WS calves showed also a higher chewing activity until the 17th wk of the trial. Subsequently, their chewing activity was similar to C calves likely because the daily dose of roughage became limiting. Behaviour of C and BP was similar. The provision of both solid feeds did not affect milk replacer intake, but it improved calves health status reducing the incidence of medical treatments. In C calves, iron intake throughout the fattening period was 6.34 g. Feeding WS and BP diets significantly increased total iron intake by 41 and 130% respectively ($P < .001$). However, before slaughtering, only BP calves showed hemoglobin and plasma iron concentrations higher than the C ones. Therefore, iron provided by WS was less available for the calf metabolism, likely because it was bound by NDF. Only feeding BP increased calves ADG (1178 g/d) ($P < .01$), whereas C and WS were similar (1078 and 1100 g/d, respectively). Both solid feeds led to empty fore stomachs heavier than C without affecting dressing percentage. The administration of BP resulted in a better carcass conformation than C and WS, but it had a detrimental effect on carcass colour which was the darkest. Consistent with this result, meat colour of BP calves was darker than C and WS. In conclusion, a solid feed with a high roughage value and a low bioavailability of iron, such as wheat straw, has shown to improve veal calves welfare allowing the production of veal meat which fulfills the colour standard required by the market.

Key Words: veal calf, solid feeds, behaviour and meat quality

1098 Effects of milk replacer fermented with yogurt culture on performance and health of dairy calves. S.C. Chan^{*}, Department of Animal Science, Chinese Culture University, Taiwan.

The objective of the study was to determine effects of non-medicated milk replacer fermented with yogurt culture on performance and health of calves and to compare economic benefit and performance of calves weaned at different time. Twenty-four female Holstein calves were randomly assigned at five days of age to one of 4 treatments in a completely randomized block design with 2 x 2 factorial arrangement of treatment. Factors were: (1) weaning time: 6 or 8 weeks; (2) milk replacer (MR): MR fermented with yogurt culture or MR without adding yogurt culture. Calves were fed colostrums twice daily through nipple bottles for 4 days. During the study calves were housed in individual, elevated calf crates. Since day 5, calves were fed non-medicated fermented MR that contained yogurt culture or non-medicated MR. A commercial, calf starter was fed "ad libitum" from day 5 to the end of trial. Body weight, wither height and heart girth were recorded when calves were on trial, and at the end of 3, 6 and 8 weeks of age. Rectal temperature and incidence of all health disorders were recorded daily. Fecal consistency scores for calves were recorded twice daily. Total bacterial, lactic acid producing bacteria, and coliform counts were determined at day 5, and at the end of 3, 6 and 8 weeks of age. Calves fed yogurt cultured MR had higher lactic acid bacterial and lower coliform numbers at week 3 and 6 ($P < 0.05$). Fecal consistency scores and days calves suffered diarrhea tended to be lower for calves fed cultured MR. Body weight gain from day 5 to week 3 tended to be lower for calves fed cultured MR than those fed regular MR ($P < 0.10$). Results also indicated that calves weaned at week 6 tended to have higher water intake and starter intake from week 6 to week 8 than those calves weaned at week 8 ($P < 0.10$).

Key Words: Calves, Milk Replacer, Yogurt Culture

1099 Absorption of immunoglobulin G in calves fed colostrum or colostrum replacement and animal plasma in milk replacer. C. M. Mowrey^{*1}, R. E. James¹, J. D. Quigley, III², and M. L. McGilliard¹, ¹Virginia Tech, Blacksburg VA, ²American Protein Corporation, Ames IA.

Newborn Holstein (n = 48) and Jersey (n = 30) calves were studied to compare the absorption of immunoglobulin G (IgG) from maternal colostrum (n = 39) or a colostrum replacement product derived from bovine serum (n = 39). Calves were also fed milk replacer with (n = 38) or without (n = 40) animal plasma to 29 d of age to determine the effect of plasma protein on IgG status, health and growth. Colostrum replacement was fed (Holsteins 1.89 L/feeding, Jerseys 1.42 L/feeding) at 1.0 and 13.0 h of age and provided a total of 250 (Holsteins) or 180 (Jerseys) g of IgG. Amount of pooled maternal colostrum fed (at 1.1 and 13.1 h) was adjusted to provide IgG equal to the replacement (Holsteins 249 g, Jerseys 186 g). Milk replacer (reconstituted to 12.5% DM) was fed at 10% of birth weight (2 feedings/d). Jugular blood was sampled at 0 h, 24 h, and weekly to determine plasma IgG. At blood collection calves were also weighed and measured to determine growth performance. Health scores, fecal scores, and grain intake were measured daily. Mean plasma IgG at 24 h did not differ between calves fed colostrum (13.78 ± 0.39 g/L) and replacement (13.96 ± 0.38 g/L). Plasma IgG and performance were not affected by addition of animal plasma to milk replacer. The colostrum substitute successfully replaced colostrum as the source of IgG for newborn calves. Animal plasma was an acceptable source of protein, but did not enhance growth or immunity.

Key Words: Colostrum Replacement, Immunoglobulin G, Animal Plasma

1100 Growth characteristics of replacement heifers in selected high producing Wisconsin dairy herds. N.C. Dorshorst^{*1}, H.A. Lonning², P.C. Hoffman¹, K.A. Weigel¹, and C. Dechow¹, ¹University of Wisconsin-Madison, ²University of Wisconsin-River Falls.

A field survey was conducted to assess growth characteristics of dairy replacement heifers in selected high producing Wisconsin dairy herds. From a pool (n=35) of Wisconsin dairy herds with herd milk production > 13,500 kg/lactation, twenty herds were randomly selected. The project involved collection of herd production data, a management survey, physical measurement of all calves and replacement heifers, and identification of sires for all calves and heifers for each herd. Physical measurements included estimation of weight via heart girth, wither height, body length, and body condition score. Statistics were compiled for herd inventories, milk production, and age at first calving. Physical measurements of heifers from all herds were compiled and summarized by month of age. Pre- and post pubertal growth of heifers for each farm were estimated using first order regression techniques. A summary of project results is as follows. Age at first calving in the selected herds was 25.9 ± 1.5 months and replacement heifers calved at an estimated pre-calving weight of 666 ± 60 kg. Regression estimated pre- and postpubertal growth rates of replacement heifers in the selected herds was 887 ± 120 and 741 ± 96 g/d, respectively. Estimated prepubertal growth rates ranged from 758 to 1243 g/d. Growth characteristics of Holstein calves and replacement heifers in the selected herds were similar to guidelines published in the literature. Survey data indicated that use of 3 x milking and rBST on both multiparous and primiparous cows was high at 77.8, 83.3, and 72.2%, respectively. Selected herds fed calves starter later, forage earlier than recommended guidelines and weaned calves using age criteria. Selected herds bred heifers using age (83.3%) more so than weight (16.7%) criteria. Data suggest replacement heifers on selected high producing dairy herds were older and heavier at first calving as compared to recommended guidelines. The influence of genetic selection on these data is yet to be determined.

Key Words: Heifers, Growth, Dairy

1101 Comparison of Lactational Response of Dairy Cows in Georgia and Israel to Heat Load and Photoperiod. Y. Aharoni¹, O. Ravagnolo², and I. Misztal², ¹Department of Beef Cattle, Agricultural Research Organization, Neve Yaar Research Center, Israel, ²Animal and dairy Science Department, University of Georgia, Athens 30605.

The seasonal effects of heat load (HL) and photoperiod (PP) during the lactation on milk yield and composition of primiparous cows were studied using test day records that were collected over an 8-year period 1990 through 1997 from 8968 cows in 76 farms in Georgia. The effect of prepartum PP on milk production in the subsequent lactation was also evaluated for these cows. These effects were tested in a regression model that accounted for a 4th order polynomial of days in milk (DIM) and fixed effects of year and farm in addition to the seasonal effects. The seasonal effects estimated for this database were compared with those estimated previously (Aharoni et al., 2000) for multiparous cows in Israel. The PP effect accounted for a difference of 2.7 kg/d of milk, 3.3 g/kg fat and 1.9 g/kg of protein in milk between peak and trough dates of the year, with peak dates at 5/02, 1/27 and 1/13 for milk yield and fat and protein contents in milk, respectively. The HL during the lactation had negative effects on milk yield and contents. The day length during the prepartum period had also negative effects on milk yield and contents. Most of the effects were highly ($P < 0.001$) significant. The match between the combined effect of HL and PP during the lactation in Georgia and Israel yielded r^2 values 0.978 and 0.984 for effects on milk yield and protein content, respectively, and $r^2 = 0.516$ for the effect on fat content. The effect of prepartum PP was similar in dates, but higher in Israel than in Georgia. This study indicated that the effects of both HL and PP during the lactation on milk yield and composition of primiparous cows in Georgia are very similar to these effects on multiparous cows in Israel. The mismatch of estimations on fat content could be explained by seasonal dietary changes due to a grazing season in Georgia, which is absent from the Israeli management. The difference in response to prepartum PP could be explained as the difference between heifers before their first calving in Georgia, and mature cows in Israel.

Key Words: Photoperiod, Heat Load, Milk Production

1102 Seasonal variation in the composition of milk from New Zealand Friesian and US Holstein dairy cows: impact of nutrition. M.J. Auldust*, A.R. Napper, and E.S. Kolver, Dexcel Ltd. (formerly Dairying Research Corporation Ltd.), Hamilton, New Zealand.

The manufacturing efficiency of dairy products is significantly limited by the seasonal variation in milk composition from pasture-based, seasonally calving dairying systems. This study tested the hypothesis that seasonal variation in milk composition is caused by changes in pasture composition and availability. Variation in milk composition was measured in 20 NZ Holstein-Friesian (NZHF) and 20 Northern Hemisphere Holstein-Friesian (NHHF) dairy cows grazing pasture or fed a total mixed ration (TMR). The study was conducted over two lactations, with samples of daily milk collected on 7 evenly-spaced occasions during Year 1 and 5 occasions in Year 2. In both years, NHHF cows produced more milk with lower concentrations of the major milk solids fat and protein, but higher concentrations of lactose, than NZHF cows. Diet also affected concentrations of some major milk components. Detailed milk composition was generally unaffected by both genotype and diet. Feeding TMR for the entire lactation reduced seasonal variation in both years for lactose concentration, and in Year 1 for milk yield, fat, casein number, urea and Na. Overall, however, the reduction in seasonal variation due to TMR, if any, was minimal. The pattern of change in milk composition as the season progressed was similar for all treatment groups and could not be explained by diet. It is concluded that improved nutrition of grazing dairy cows would not significantly reduce seasonal variation in milk yield and composition.

Year	NZHF Grass		NZHF TMR		NHHF Grass		NHHF TMR		P A1	
	1	2	1	2	1	2	1	2	1	2
Yield	3.62	5.32	2.42	4.79	4.43	5.80	2.64	5.81	**	NS
Fat	3.91	5.54	5.25	5.64	4.24	4.68	5.63	5.64	**	NS
Protein	2.42	2.62	1.94	3.07	2.48	2.02	1.69	2.89	NS	*
Casein	2.06	1.92	1.69	2.37	1.98	1.52	1.54	2.24	NS	*
Lactose	1.38	2.08	0.71	1.46	1.46	1.85	0.73	1.16	**	**
Casein										
No.	0.020	0.011	0.018	0.010	0.023	0.011	0.015	0.010	**	NS
BSA	33.9	41.3	23.9	44.2	33.9	38.7	32.6	43.7	NS	NS
Urea	1.69	1.02	1.27	0.83	1.97	1.26	1.41	1.18	**	NS
Na	2.3	7.7	8.2	8.2	10.3	8.3	10.8	7.8	NS	NS

Data are standard deviations across the season - NOT absolute values ¹ Significance of diet effects on variation (no significant genotype effects); ** $P < 0.01$; * $P < 0.05$; N.S. = not significant

Key Words: Milk composition, Seasonal variation, Pasture

1103 Milk and meat samples obtained in Illinois contain variable amounts of conjugated linoleic acid. A.D. Beaulieu* and J.K. Drackley, University of Illinois, Urbana .

The objective of this study was to determine the mean content and variability of conjugated linoleic acid (CLA) in Illinois meat and milk. Samples of whole milk were obtained from 30 grocery stores over a one-year period and from 5 to 6 farms (bulk tank samples) in three geographic locations at three-month intervals for one year. Producers supplied feeding and management records. Eight cuts of meat were purchased from 24 stores at six-month intervals for one year. Sites were selected for sampling based on population density. Store milk contained a mean CLA content of 0.53 ± 0.02 (mg/100 mg fatty acids (FA) mean ± SEM) with a range of 0.43 to 0.81 mg/100 mg FA. The CLA content of milk obtained from producers averaged 0.53 ± 0.21 mg/100 mg FA with a range of 0.29 to 1.63 mg/100 mg FA. The highest value was from the only producer reporting 100% grazing. Complete or partial grazing increased ($P < 0.05$) CLA content of milk fat. Season, state location, breed, and fat supplementation did not affect ($P > 0.05$) CLA content of milk fat. The CLA content of milk fat was positively correlated ($P < 0.05$) with the C18:1_{cis-9} and the C18:1_{trans} content of milk fat and total milk production (kg/d) and negatively correlated ($P < 0.05$) with milk fat and milk protein percent. The following table presents the mean CLA content of the meat samples (lean tissue unless specified otherwise). The content of CLA in meat samples was similar ($P > 0.05$) among stores. The variable CLA content of milk and meat hinders the accurate estimation of CLA intake by a population. However, identifying the source of this variability will assist the development of CLA-enriched milk and meat.

Sample	CLA (mg/100 mg FA)			
	Mean ¹	Season		P-value
		March	August	
Ground beef	0.57 ^a	0.53	0.61	0.0023
Beef roast	0.46 ^b	0.36	0.55	0.0014
T-bone steak	0.41 ^c	0.34	0.48	0.0001
Turkey skin	0.22 ^c	0.20	0.23	0.4255
Turkey	0.20 ^d	0.21	0.19	0.4253
Chicken	0.15 ^e	0.19	0.10	0.0032
Pork chop	0.14 ^e	0.12	0.17	0.1028
Chicken skin	0.09 ^f	0.07	0.11	0.1441

¹SEM = 0.02, n = 24. ^{a,b,c,d,e,f} Values within a column are significantly different ($P < 0.05$).

Key Words: Conjugated linoleic acid, milk, meat

1104 Relationship of milk urea nitrogen and DHIA production variables in western commercial dairy herds. R.G. Johnson*, J.L. Walters, and A.J. Young, Utah State University, Logan, Utah.

Studies have shown relationships between milk urea nitrogen (MUN) and milk production levels in eastern and central North America. Feeding and management are different under western conditions and standard MUN concentrations are not known. Because MUN concentration has been associated with nitrogen utilization efficiency, it could become a useful management tool for dairy producers. The objective of this

study was to evaluate the relationship of MUN values with DHIA production values in commercial dairy herds in Utah and Idaho. Individual cow monthly test records (approximately 25,000) from 37 Holstein and 4 Jersey herds were analyzed. Records spanned two consecutive years ending December 2000. Mean test day milk yield per cow for all animals was 31.9 kg. Overall mean MUN was 14.88 mg/dl. Two statistical models were developed using the General Linear Model procedure of SAS. One model with MUN as the dependent variable had an r-squared of 0.27. Significantly related independent variables were: parity and somatic cell count (both linear); milk per cow, milk protein %, milk fat %, days in milk and month of year (cubic). When milk per cow was the dependent variable the r-squared was 0.51. Significantly related independent variables were: milk fat %, parity, MUN, milk protein %, somatic cell count, days in milk and month of year (all cubic). There were differences between cows of the Holstein and Jersey breeds with respect to MUN and season. Holstein MUN was highest in winter, while Jersey MUN was highest in summer. There was no significant breed difference in mean MUN. Our data show that MUN is associated with DHIA production variables and can be used to develop optimal MUN concentrations unique to western dairies.

Key Words: MUN, DHIA

1105 Stochastic modeling of different approaches to dairy cattle reproductive management. M.W. Overton*, U.C. Davis- *Veterinary Medicine Teaching and Research Center.*

A stochastic simulation model was used to compare potential economic returns of three popular synchronization programs, Ovsynch, Presynch, and Modified Presynch, as compared to a traditional breeding program based on artificial insemination following heat detection. The model applied these programs early in the breeding period, followed by traditional breeding for the remaining cycles. Interventions were modeled using a combination of decision tree analysis, partial budgeting, stochastic simulation modeling, and economic sensitivity analysis. Herd specific inputs included voluntary wait period, drug costs, breeding expenses, and labor costs. Conception rate, heat detection rate, and rolling herd average were input as distributions rather than discrete probabilities. Data from over 100 conveniently sampled California dairy herds was used to fit the specific distributions. Conception rate and heat detection rate changes over the breeding period were modeled by applying correction factors to the original distributions. Pregnancy rate results predicted for each cycle were then used to project cumulative pregnancy rate over 10 breeding cycles. Results were obtained by running 5000 iterations through the use of simulation software and are displayed as probability distributions, with a mean and standard deviation. The model predicted that implementation of any of the three breeding programs early in the breeding period would improve pregnancy rate during the modeled cycle and throughout the balance of the breeding program. Predicted economic returns, using modifications of the Woods equation, were greater for each of the interventions as compared to traditional breeding utilizing current levels of heat detection and conception rate.

Key Words: Dairy, Reproduction, Stochastic Modeling

1106 Changes in rumen temperature, vaginal temperature and drinking behaviour throughout the estrous cycle in dairy cows. A. D. Kennedy* and S. R. Mathew, *University of Manitoba.*

Four first calf Holstein dairy heifers (71 to 161 d postpartum) fitted with rumen cannulae were monitored continuously for 66 d. Temperature radiotransmitters were situated in both the rumen and vagina and temperature values were recorded every 4 minutes. Heifers were synchronized twice using the Ovsynch program with the first GnRH injections given on days 9 and 53 such that there were two induced ovulations and one natural ovulation expected during the study. Milk progesterone analysis indicated 13 periods of corpus luteum (CL) regression but temperature values were available for only 8 (vaginal) and 7 (rumen) of these occasions. Vaginal and rumen temperature peaks were found during 8 of 8 and 5 of 7, respectively, periods of CL regression. Rumen temperature was highly variable and a number of peaks were observed when the CL was not regressed (26 false positives). Reduced drinking behaviour was found on the day of estrus suggesting that peaks in rumen temperature reflect reduced water intake.

Key Words: Temperature, Vaginal, Rumen

1107 Follicular growth in lactating cows receiving recombinant bovine somatotropin, gonadotropin releasing hormone, and prostaglandins: contrasts between winter and summer months. Z Keister*, R Collier, and R Ax, *University of Arizona, Tucson, AZ/USA.*

Three experiments were conducted with Holstein (n = 72) and Brown Swiss (n = 73) cows beginning 56 ± 3.5 d postpartum to determine ovulation rates in a thermal stress arid climate over three consecutive seasons (Summer, 1999; Winter, 1999-2000; and Summer, 2000). All cows received recombinant bovine somatotropin (rbST) beginning d 63 ± 3.5 postpartum regardless of treatment. For Exp.1, 58 cows were assigned at calving, beginning June 1, 1999, to either a cooled (Korral Kool#) or non-cooled (shade only, control) pen. At d 56 ± 3.5 postpartum, all cows commenced a hormonal program coined Select Synch, comprised of an injection of gonadotropin releasing hormones (GnRH, 100 micrograms) agonist (Factrel#) followed 7 d later with an injection of prostaglandin (25 mg In-Synch#), at which time ultrasonography was initiated and continued until ovulation or follicular turnover. Exp. 2 was the same as Exp. 1, with assignment of cows starting Nov. 1, 1999. In Exp.3, all cows were assigned the same as Exp. 1 and 2 beginning June 1, 2000. At d 56 ± 3.5 postpartum, cows were scheduled to commence Ovsynch, which was identical to Select Synch, except a second Factrel# injection was administered 33 h after 35 mg Lutalyse#. Ovsynch was more effective at causing subsequent ovulations for the non-cooled and cooled cows (77.3 and 69.6%, respectively), than Select Synch for the non-cooled, cooled, and winter treatments (27.6, 24.1 and 29.4 %, respectively). In conclusion, ovulation outcome was related to hormonal programming rather than season.

Key Words: Follicle growth, GnRH, prostaglandin

1108 The relationship of indicators of thermal balance and milk production of cows on Missouri dairy farms. James Spain*¹, Julie Sampson¹, and Don Spiers¹, ¹ *University of Missouri.*

Three dairy farms cooperated in conducting an on farm experiment to evaluate heat stress of dairy cattle. The farms were located in Missouri in Bates, Callaway, and Franklin counties. All three farms used Holsteins housed in free stall housing systems. Farms provided cows with total mixed diets unique to the specific farm. All three farms milked twice daily (0400 to 0800 and 1600 to 2000). Lactating dairy cows were selected on each farm to create uniform groups of cows across the farms. Selected sentinel cows were housed together within larger groups of cows. Milk yield was measured and recorded on each cow at each milking during the experiment. Respiration rate, rectal and skin temperatures were measured for each cow three days a week (Monday, Wednesday and Friday) and three times per day (0800, 1400 and 2000 hours). Skin temperatures were measured at three different locations (tail head, rump and shoulder). Animal thermal balance indicators were regressed with milk production to identify those factors affecting milk yield. On Farm A, two barns were used with primiparous cows and multiparous cows housed separately. Regression analysis found a strong and significant relationship between animal thermal balance and milk yield on all three farms. On Farm A, the shoulder and rump skin temps at 0800, shoulder and rump temps at 1400, and tailhead skin temps at 2000 were related to milk yield (R²=.72). In comparison, the primiparous cows included all skin temps and rectal temp recorded at 0800, shoulder and tail skin temps at 1400, rectal and shoulder temps at 2000 as well as respiration rates at 1400 and 2000 (r²=.61). Milk production of cows on Farm B was related to Respiration rate at 0800 and 2000, Rump temp at 0800 and 1400, shoulder skin temps at 1400 and 2000 and rectal temps at 0800. Cows on Farm C had milk production related to the 0800 rectal, rump skin, and tail skin temps, 0800 rectal temp, rump and shoulder skin temps at 1400 and 2000 and respiration rates at 0800 and 1400. The 1400 and 2000 measurements were less consistent in predicting milk yield. Early morning measurements were consistently and strongly related to milk yield indicating night time environmental conditions strongly affect the cows thermal balance and milk yield.

Key Words: Heat Stress, Thermal Balance, Milk Production

1109 Effect of feeding of yeast to crossbred calves. DilipKumar Garikipati*¹, Sarjan Rao Kapa¹, Rajasekar K², and Kailash MM³, ¹College of Veterinary Science, Tirupati, ²College of Veterinary Science, Hyderabad, ³Bangalore Agricultural University.

Thirty eight HF crossbred calves of F2 generation (age= 1 day) were allotted to one of two dietary treatments. Calves were offered a commercial calf starter with (yeast) or without (control) 10g/Kg of commercial yeast ad libitum for 56 days. Calves were allocated to treatments over 40day period and were housed in individual calf hutches. Calves were fed 4L/day pasteurized milk in 3 equal feedings. Calves starter (yeast and control) were offered ad libitum starting day 2 until day 56. Calves were weaned when they consume 800g of calf starter for 3 consecutive days. Body weight of calves was recorded at entry, weaning 4 at (BW) 56 days. Data were analysed as a completely randomized design using ANOVA procedures. Three calves one from control and two from yeast were removed due to health problems. Calves fed control were weaned earlier (51.8 Vs 55.2, p<00.2) as compared to calves fed yeast. Inclusion of calf starter reduced 56 day starter in take (23.9 Vs 30.6 kg, p<00.4). There were no differences in BW at weaning, BW at 56d, average daily gains or feed efficiency between calves fed control or yeast. Data suggest yeast culture inclusion in calf starter decreased starter in take and increased weaning age.

item	control	yeast	S.E	P<
Begin BW, kg	28.4	28.8	.97	.39
Weaning age, d	51.8	55.2	1.21	.05
Weaning BW, kg	45.8	47.2	1.07	.67
56d BW, kg	47.1	46.1	1.82	.12
56d ADG, g/d	334	321	24.8	.38
Starter in take, kg	30.6	23.9	2.43	.04

Item Control Yeast S.E P< Begin BW, kg 28.4 28.8 .97 .39 Weaning age, d 51.8 55.2 1.21 .05 Weaning BW, kg 45.8 47.2 1.07 .67 56d BW, kg 47.1 46.1 1.82 .12 56d ADG, g/d 334 321 24.8 .38 Starter in take, kg 30.6 23.9 2.43 .04

Key Words: yeast, calves, starter

1110 The response of a non-medicated replacer containing a mannanoligosaccharide on growth and health parameters in neonatal dairy calves. A. J. Heinrichs*, M. R. Long, and T. S. Schriefer, *The Pennsylvania State University, University Park, PA.*

The objective of this experiment was to study the effectiveness of a non-medicated milk replacer containing a mannanoligosaccharide (BioMos, Alltech, Inc) on growth and health in dairy calves. Seventy-two Holstein calves (heifers and bulls) were used to evaluate a 20% CP 20% fat milk replacer with either Neo-Terramycin (400gms/ton Neomycin + 200 gms/ton Oxytetracycline; NT), mannanoligosaccharide (4 g/hd/day; MO) or no additions (C) in a randomized block design. The replacer was mixed at 10 oz./2 quarts of water and fed at a rate of 12 percent of birthweight/day through the end of the first week of age and then increased to 14% of birthweight until weaning at 35 d. Calves had a significantly higher probability (P < .01) of normal fecal scores including consistency, color, and severity of scours, with both the NT and MO treatments. Treatment of clinical scours occurred on 5 calves on C, 3 on NT, and 2 on MO. The rate of feed intake increase as determined by week of age, was significantly greater (P < .05) for the MO treatment over the NT treatment. There were no significant differences in any weight gain or structural growth at the conclusion of the study. Total blood protein levels were not different for any treatments; values were 5.3, 5.3, and 5.4 mg/ml for C, NT, and MO treatments respectively. Blood urea nitrogen values were 10.0, 10.4, and 10.0 mg/dl for C, NT, and MO treatments, respectively. The addition of a mannanoligosaccharide improved fecal scores in a similar or slightly better manner than did the NT treatments over the C calves in this study. Feed intake was improved in the calves fed the MO over the NT treatment, however this increased feed intake was not great enough or for an extended period of time to cause any differences in body weight during the 6 weeks of this study. The NT treatment appeared to improve feed efficiency at the end of the study. The addition of a mannanoligosaccharide in the milk replacer appeared to be beneficial to reducing scours in the calves and promoted greater feed intake.

Key Words: Dairy calves, Growth, Milk replacer

1111 Evaluation of spray dried animal plasma addition to milk replacer fed to calves at 2 feeding rates. D. R. Catherman*, *Strauss Feeds, Watertown, WI.*

Eighty-five Holstein heifer calves (average 37.9 kg BW) were used to evaluate the addition of 5% spray dried animal plasma (AP) to milk replacer (MR) compared to all milk proteins (AM) when fed a two feeding rates. Calves were allotted by weight to one of four treatment groups and fed as follows: treatment 1, AM fed at 454 g/d; treatment 2, AP fed at 454 g/d; treatment 3, AM fed at 681g/d and treatment 4, AP fed at 681 g/d. All treatments were formulated at 22% protein and 20% fat and fed in a volume of 3.8 l/d. Calves were weaned at 35 d and feed intake was recorded for 42 d. Calves were weighed at 0, 21 and 42 d. Water and starter grain (18% protein) were offered free choice from d 3. Total MR intakes were 13.5, 13.5, 18.0 and 18.0 kg for treatments 1 through 4, respectively. Total starter intakes were numerically higher for treatments 1 (37.4 kg) and 2 (38.3 kg) than for treatments 3 (34.6 kg) and 4 (36.1 kg). Weight gains between d 0 and 21 were lower (P<.05) for treatments 1 (10.0 kg) and 2 (10.0 kg) than for treatments 3 (12.2 kg) and 4 (12.3 kg). Between d 21 and 42, weight gains were higher (P<.05) for treatments 1 (12.4 kg) and 2 (13.6 kg) than for treatments 3 (11.8 kg) and 4 (11.3 kg). Overall weight gains (d 0 to 42) were not different. Feed cost per kg of gain was not different, but tended to be lower for treatments 1 (\$1.36) and 2 (\$1.28) than for treatments 3 and 4 (\$1.52). Scour scores were not different. Medication costs tended to be lower in treatments containing AP (\$10.49, \$9.96, \$10.18 and \$9.32 per calf for treatments 1 through 4, respectively). These data indicate AP offers an acceptable alternative to whey proteins in milk replacer formulations at 5% inclusion rate. Feeding rate did not impact the acceptability of AP. Inclusion of AP may have influenced the overall health of the calves based on medication costs, although more data will be required to confirm this tendency.

Key Words: calves, milk replacer, animal plasma

1112 Effects of Supplemental Vitamin E and Lasalocid on Disease Severity and Immune Responses of Calves Challenged With *Eimeria bovis*. G. E. Goodier*¹, C. C. Williams¹, K. L. O'Reilly², T. G. Snider², J. C. Williams¹, H. G. Bateman, II¹, D. T. Gantt¹, and C. M. Cheatham¹, ¹LSU Agricultural Center, Baton Rouge, LA, ²LSU School of Veterinary Medicine, Baton Rouge, LA.

Thirty-two male Holstein calves were utilized in a completely randomized design with a 2x2 factorial arrangement of treatments to investigate the use of Vitamin E (Vit E) alone or in combination with lasalocid (LAS) in the control of coccidiosis. Coccidiosis was experimentally induced using an oral dose of 100,000 *E. bovis* oocysts when calves were 2 wk of age. Calves received colostrum (COL) for the first feeding and then the colostrum supplement Lifeline[®] (LL) (American Protein Corporation) at the second feeding. All calves were fed milk replacer (MR) containing 20 IU Vit E/lb at 10% of birth weight. At wk 4, MR was reduced 50% and calves abruptly weaned at wk 5. Vit E treated calves (n=16) were given 180 IU Vit E (Roche Vitamins, Inc.) in the MR once daily and then orally drenched after weaning. LAS treated calves (n=16) were given LAS (Roche) at 1mg/kg of body weight in both MR and starter. Fecal scores were recorded twice daily, and body weights were recorded weekly through the 8 wk study. Blood samples were collected and analyzed for whole blood IgG (Midland BioProducts) before the LL feeding and 24 hours later. Blood and saliva were collected from each calf at 24 hrs and 2, 4, 6, and 8 wk of life to determine levels of total Igs, IgG₁, IgM, and IgA. Four calves from each study were killed at wk 8 for examination of grossly visible intestinal lesions. Whole blood IgG revealed 14 calves failed to receive adequate Igs from COL or LL, but these results had no effect on calf performance. Calves fed LAS had higher (P = 0.06) levels of total Igs from wk 3 until the end of the study. Control (C) calves had lower IgM levels throughout the study (P > 0.05), and calves fed Vit E alone had increased levels of IgM at wk 6 and 8 (P < 0.05). No differences in IgG₁ and IgA levels were observed between treatment groups (P > 0.05). Prevalence and severity of infections were greater in C and Vit E calves compared to those fed LAS. Post mortem analysis revealed that by wk 8 no intestinal lesions were present, indicating recovery from the disease. While supplemental Vit E alone did not improve calf performance, LAS was effective in decreasing severity of coccidiosis in this study.

Key Words: Coccidia, Lasalocid, Vitamin E

1113 Effect of monensin, lasalocid, and decoquinatone on growth, feed intake, and feed efficiency of dairy heifers. D.G. Schmidt^{*1}, J.E. Shirley¹, E.C. Titgemeyer¹, M.V. Scheffel¹, and E.E. Thomas², ¹Kansas State University, Manhattan., ²Elanco Animal Health, Greenfield, IN.

One hundred eighty Holstein heifers were used in a randomized block design to evaluate response to starter diets containing decoquinatone (D), monensin (M), or lasalocid (L) and the benefits of ionophores in grower diets during the transition from individual hutches to group pens. Treatments (90% air dry basis) for the first eight weeks of age (Phase 1) were M (33 mg/kg), L (83 mg/kg), or D (33 mg/kg). Heifers within each Phase 1 treatment group were ranked by weight and alternately assigned to either M or L and housed in pens containing 5 heifers each during an 84-d growing period (Phase 2). During Phase 2, heifers were fed only a grain mix containing M (31 mg/kg) or L (31 mg/kg) for the first 14 d, then a grain mix with chopped alfalfa hay during the second 14 d and a TMR the last 56 d. Diets were fed during the first 28 d to allow ad libitum intake (5% orts). Ionophores were delivered (100 mg/heifer daily) with the TMR as a top dress with finely ground corn. No difference in daily gain, feed intake, feed efficiency, or body weight gain was observed among treatments during Phase 1. Heifers fed ML gained slower during the 84-d growing period (Phase 2) than heifers fed the other treatments ($P < 0.05$). Heifers fed D (Phase 1) performed similarly when switched to M or L. Heifers switched from L to M performed similarly to heifers fed LL or MM. Results of this study suggest that heifers fed D or L prior to weaning can be successfully switched to M during the growing phase, but heifers fed M prior to weaning will not perform as well if they are switched to L during the growing phase.

Treatment Schemes¹

Phase 1	D		L		M	
No. of Heifers	60		60		60	
Phase 2	L	M	L	M	L	M
No. of Heifers	30	30	30	30	30	30
No. of Pens	6	6	6	6	6	6
Treatment	DL	DM	LL	LM	ML	MM

¹D = decoquinatone, L = lasalocid, M = monensin.

Key Words: Dairy heifer, Ionophores, Decoquinatone

1114 Effect of rearing methods of dairy-heifers prior to weaning on growth and reproduction. Jan J.J. Broucek^{*1}, Clive W. Arave², Ted H. Friend³, Stefan Mihina¹, Michael Uhrincat¹, Anton Hanus¹, Stefan Marencak¹, and Peter Kisac, ¹Research Institute of Animal Production, Nitra, Slovakia, ²Utah State University, Logan, USA, ³Texas A&M University, College Station, USA.

Holstein heifer calves (n = 92) were assigned to one of five rearing treatments after having nursed their dams for 24 h: A) individual hutches until 7 d of age followed by group housing with a machine milk feeder until weaning at 8 weeks; D) penned with dam until 7 d of age followed by group housing with a machine milk feeder until weaning; H) individual hutches until weaning; M) penned with dam for the first 7 d followed by an individual hutch until weaning; N) penned with dam for the first 7 d followed by penning with a nursing cow until weaning. Animals of all groups were kept after weaning in age-balanced groups in bedded pens with the same balanced ration. Parturition was classified according to a point system, i.e. 1) - no help, 2) - assisted by one person, 3) - assisted by 2 to 3 persons, a small injury of the genital tract, 4) - difficult parturition. Live body weight at the birth was not significantly different. At 180 d of age, statistically significant differences $P < .05$ were found in weight gains between N, D and A, and between H and A. The ranking of animals was: N (.79 kg), H (.74 kg), M (.71 kg), D (.68 kg), A (.64 kg). A slightly increased growth in live body weight in the groups N, M and H continued until the age of 630 days. The order of groups according to the average live body weight at 21 months was: N (491 kg), H (486.5 kg), M (481.6 kg), A (477 kg), D (468 kg). From the birth until the twenty-first month, the average daily weight gains were no significant: N (.71 kg), H (.71 kg), M (.70 kg), A (.69 kg), D (.67 kg). Conception ages (H=555 d, M=554.7 d, N=549 d, D=534.5 d, A=530.6 d) nor live body weights at day of conception (H=455.4 kg, N=449 kg, A=426.6 kg, M=426.5 kg, D=418 kg) were not significant. The most difficult calvings (not significantly) were in group M (2.4) and the easiest in group H (1.6). A significant difference ($P < .05$) was found in the birth weight of calves born to mothers in groups N (42.4 kg) and D (36.4 kg). The

results show that the rearing conditions had little long-term effect on the variables measured.

Key Words: Dairy cattle, Rearing, Growth

1115 Prediction and ranking of first lactation milk production using parents' predicted transmitting abilities. B. R. Radke^{*1}, J. W. Lloyd², J. B. Kaneene², J. R. Black², and S. Harsh², ¹Alberta Agriculture, Food and Rural Development, Edmonton, AB, ²Michigan State University, East Lansing, MI.

Decreased culling rates can increase the net income of dairy producers by increasing cow longevity. To decrease the culling rate, the replacement rate must also be reduced, necessitating a method of prepartum heifer selection. First lactation milk production is a proxy for dairy cow profitability and is a suitable heifer selection objective. The objectives of this study included determining: 1) the ability of parents' predicted transmitting abilities (PTAs) for milk, fat and protein to predict daughters' subsequent first lactation milk production; 2) the ability of the predictions of first lactation milk production to correctly rank heifers within herd based on actual milk production; and 3) whether, in estimating this linear relationship, the herd effect needed to be estimated as a fixed effect. The data consisted of first lactation mature equivalent milk production of 5,123 Michigan Holstein heifers from 576 herds, and the heifers' parents' animal model evaluations immediately prior to the heifers' calvings. The heifers were born in the last six months of 1992 and calved in the last six months of 1994. Linear regression of parents' PTAs on daughters' subsequent first lactation milk production resulted in $R^2 = 0.068$ and $R^2 = 0.067$ when herd was estimated as a random and fixed effect, respectively. The distribution of within herd Spearman rank correlations between the predicted mature equivalent milk production (based on parents' PTAs) and the actual mature equivalent milk production was diffuse, skewed to the left, and had a median of 0.25 with 65% of the herds having a positive rank correlation. This suggested the PTAs had some ability to correctly rank the prepartum heifers' subsequent first lactation milk production, and therefore may be useful in prepartum heifer selection. Treating herd as a fixed or random effect resulted in statistically different ($P < 0.0001$) models. However, the predictions from the two models had Spearman rank correlations greater than 0.90 for 96% of the herds suggesting that in practical terms, it is unclear whether herd needs to be estimated as a fixed effect.

Key Words: Prediction First Lactation Production, Random Effect, Fixed Effect

1116 Effect of wheat variety and replacing wheat with maize grain on feed intake and milk production of Holstein dairy cows. R.H. Phipps^{*}, J.D. Sutton, and A.K. Jones, *The University of Reading, Reading, UK.*

Fifteen multiparous cows were used in a 5 x 5 latin square trial with five, four-week periods. Cows were offered ad libitum a forage mixture of maize silage (368 g DM/kg, 308, 329 and 85 g/kg DM, starch, NDF and CP) and grass silage (325 g DM/kg, 496 and 132 g/kg DM, NDF and CP) in a 3:1 DM ratio. Cows received 12kg/d fresh weight (fwt) of one of five different concentrates (T1-T5), all of which contained 400 g/kg fwt of cereal grain. The nutritive value of concentrates was similar. In T1 and T2 wheat varieties Rialto (high viscosity) and Soissons (low viscosity) formed 100% of the cereal grain component. In T3, T4 and T5 maize grain replaced Rialto wheat to give the following proportions of wheat and maize grain, 62.5:37.5, 37.5:62.5 and 0:1. Feed intake and milk yields, for T1-T5 (respective means and s.e.d.) were 22.1, 21.5, 21.8, 22.3, and 22.2 (0.31) kg/d and 35.8, 36.3, 35.7, 36.6 and 37.4 (0.77) kg/d. The corresponding values for milk fat and protein contents were 37.1, 36.7, 35.9, 35.5 and 37.3 (1.64) g/kg and 31.7, 31.6, 31.7, 31.8 and 31.6 (0.29) g/kg. Yields of milk fat and protein for T1-T5 were 1326, 1330, 1279, 1285 and 1386 (60.6) g/d and 1128, 1142, 1126, 1157, and 1179 (25.5) g/d, respectively. Although feed intake for T1 was higher ($P < 0.05$) compared with T2, milk production was unaffected by wheat variety. Replacing Rialto wheat with maize grain did not affect feed intake but increased ($P < 0.05$) milk yield from 35.8 to 37.4 kg/d. Regression analysis showed a linear effect ($P < 0.05$) of increasing the proportion of maize grain in the concentrate (from 0 to 100% of cereal grain) on milk yield (1.7 kg/d 0.75) and protein yield (55 g/d 24.7). There were no effects on milk composition. Results indicate that increased supply of bypass starch through the use of maize grain could

increase milk production in UK dairy herds but a cost benefit analysis is required to determine its economic feasibility.

Key Words: Dairy cows, Milk production, Maize and wheat grain

1117 Evaluation of cow preference between modern and old free-stall design. R. J. Norell^{*1}, A. Ahmadzadeh², and E. P. Wagner², *University of Idaho*, ¹*Idaho Falls*, ²*Moscow*.

Cow preference was assessed between old and modern design freestalls. Two pens of 20 lactating Holstein cows were each provided 9 modern stalls (MOD) and 9 old stalls (OLD). MOD stalls were wider (1.22m vs 1.14m), had taller stall dividers (1.22m vs 0.91m), and had improved forward/sideways lunge space. OLD stall bases were deep sand over concrete blocks in pen 1 and deep sand over clay filled tires in pen 2. MOD stalls had sand over commercial rubber filled mattresses. Cow behavior was scanned every 15 minutes during a 7.5 h observation period on nine evenings (8PM to 3:30AM). Behavioral data were summarized by stall and analysed with a split plot in time ANOVA for each pen. For pen 1, LSM means and SE for %occupancy, %resting, %standing, and stall turnover rate were: 84.7 vs 78.2 ±2.8; 74.1 vs 67.0 ±2.3; 10.5 vs 11.1 ±0.9; 3.3 vs 3.9 ±0.2 for MOD and OLD, respectively. For pen 2, LSM means and SE for %occupancy, %resting, %standing, and stall turnover rate were: 90.5 vs 64.0 ±5.0; 82.2 vs 50.4 ±5.4; 8.3 vs 13.6 ±1.4; 3.2 vs 3.0 ±0.2 for MOD and OLD, respectively. Cows spent more time occupying MOD in pen 2 ($p < 0.006$) but not in pen 1. Cows spent more time resting in MOD stalls in both pen 1 ($p = 0.06$) and pen 2 ($p < 0.003$). Standing behavior was not different in pen 1 but was higher ($p < 0.03$) for OLD in pen 2. Stall turnover rates were similar between stall designs in both pens. We conclude that modern stalls with greater width, improved lunge space, and rubber filled mattress are preferred by lactating cows as evidenced by improved occupancy and resting behavior.

Key Words: Free-stalls, Cow Preference

1118 Whole-farm nitrogen efficiency and balance compared with the milk urea nitrogen test. R.A. Swain^{*1}, J.L. Walters¹, R.A. Kohn², and A.J. Young¹, ¹*Utah State University, Logan, UT*, ²*University of Maryland, College Park, MD*.

Environmental legislation has made it necessary for producers to be able to quantify and adjust the nitrogen (N) balance on their farms. Milk urea nitrogen (MUN) was evaluated as a practical means of evaluating whole-farm N balance. Forty-one commercial dairies in UT and ID were contacted and evaluated for whole-farm N balance using the University of Maryland Nutrient Balancer. Producers were interviewed in order to obtain annual amounts of purchased feed and fertilizer, crops grown and sold, cows purchased and sold, exported manure, pounds of milk sold, number of cows and heifers, and production characteristics such as milk protein and rolling herd average. MUN concentrations were collected from two consecutive DHIA tests. Freshly excreted and stored manure samples were collected. Individual whole-farm N balance and N utilization efficiency were determined. Whole farm N utilization efficiencies, based on MUN, were calculated using the models of Jonker et al. (*J. Dairy Sci.* 81:2681) and Kauffman and St. Pierre (*J. Dairy Sci.* 82 (Suppl. 1): 95). Herds ranged from 57-1960 cows, 6568-13863 kg of milk/cow, 9.5-20.5 mg/dl MUN, 12.6-36.2% N utilization efficiency, and 2.52-445.52 tonnes/yr potential N loss. A multiple regression model was run with whole-farm N balance (tonnes/yr) as the dependent variable. Significant independent variables were: number of cows, imported feed and fertilizer N, exported manure N, and herd N utilization ($r^2 = 0.98$). This suggests lower N balance on farms where all feed is imported. Herd N utilization had the single largest effect on N balance; an increase of 1.0 % resulted in a decrease of 1.88 tonnes/yr ($P < 0.0001$). Number of cows showed the smallest effect and did not affect N balance per unit of product produced ($P = 0.585$). The Jonker et al. ($r^2 = 0.15$, $r^2 = 0.19$) and Kauffman and St. Pierre ($r^2 = 0.12$, $r^2 = 0.10$) models were significant when regressed on herd N utilization and N balance, respectively. MUN may be a useful indicator of whole-farm N balance. Funded by SARE grant SW99-024.

Key Words: MUN, Whole farm nitrogen balance, Nitrogen efficiency

1119 Determining the relationships among milk urea nitrogen and milk production, milk protein, milk fat and somatic cell count from lactating cows in Texas. G.M. Goodall^{*1}, M.A. Tomaszewski¹, L.W. Greene², R.B. Schwartz¹, J.W. Stuth¹, and E.M. Sudweeks³, ¹*Texas A & M University, College Station, TX./USA*, ²*Texas A&M University Research and Extension Center, Amarillo, TX./USA*, ³*Texas A&M University Research and Extension, Overton, TX./USA*.

The objectives of this study were; 1) determine the relationship among Milk Urea Nitrogen (MUN) and milk production, milk protein, milk fat and somatic cell count, 2) determine economic consequences of reducing excessive milk urea nitrogen and phosphorus in the dairy cow diet. The potential impact was the development of a relationship among the components and MUN levels to alert producers of protein inefficiencies or excesses. Excessive protein has increased environmental nitrogen loading, increased feedcost, and resulted in adverse reproductive performance. Component pricing of milk has encouraged critical evaluation of milk records. This included the evaluation of the fat: protein ratio. The data was collected monthly over the course of 3 years. Over 20,000-cow testday records were collected including; calving interval, freshening date, days open, lactation number, longevity, days in milk, test day milk, milk components and their ratios, peak milk, MUN, and feeding program. The herd size varied from 110 cows to 852 cows. The feeding programs represented included Total Mixed Ration (TMR) fed herds and pasture-grazed herds. The economic evaluation objective looked at two main goals; 1) evaluation of the effect of milk urea nitrogen on longevity and milk production, and 2) calculation of decreased costs associated with decreased phosphorus levels. Previous TAMU extension demonstration data indicated a potential saving of \$14,000.00 per year for a 16% reduction in manure phosphorus in a 1000-cow herd. MUN levels were significantly affected by season, and feeding program. Peak milk production was significantly lower and MUN levels were significantly higher with the grazing herds. The data indicates the need to evaluate MUN levels based on feeding programs and season. Combining the MUN and component evaluation utilizes herd records for economic and environmental benefit.

Key Words: Dairy-cows, Environment-nitrogen and phosphorus, Monitoring-milk components, mun

1120 Comparing nutrient analysis of liquid dairy waste in storage versus field application. R. J. Norell^{*1}, S. C. Parkinson², and D. E. Falk³, *University of Idaho*, ¹*Idaho Falls*, ²*Preston*, ³*Twin Falls*.

Sampling of liquid dairy waste is necessary for reliable nutrient application rates to farm crops. The objective of this study was to compare sampling from storage versus sampling during land application. Three methods of land application were evaluated: (GRAVITY) liquid transport by gravity flow to gated pipe irrigation, (PUMP) pumping to gated pipe irrigation, and (TANK) pumping into a tractor drawn vacuum tank. Four pairs of samples were collected at each dairy. Each pair included a storage sample and a land application sample. Overall data were analyzed with a paired t-test ($n=48$ pairs). Mean storage concentration, mean difference (storage minus field) and SE of difference were: 0.99, 0.19±0.07; 0.48, 0.21±0.07; 506.0, 69.1±18.9; 91.2, 14.8±4.0; 39.5, -0.6±1.0; and 1272.6, -9.3±14.6 for (DM) % dry matter, (SS) % suspended solids, (TKN) ppm total kjeldahl nitrogen, (P) ppm total phosphorus, (OP) ppm ortho-phosphorus, and (K) ppm potassium, respectively. DM, SS, TKN, and P were significantly higher in storage samples ($p < 0.005$) but OP and K were not different between storage and field sample pairs. Mean differences in SS, P, and K were larger for TANK ($p < 0.05$) than in GRAVITY and PUMP sample pairs. Sampling liquid waste at the storage facility appears to overestimate the amount of nutrients actually applied to field crops.

Key Words: Dairy waste, Nutrient concentration, Sampling technique

1121 Utility of body condition score (BCS) system in relation to the physical and production parameters in crossbred cows. Dilipkumar Garikipati^{*1}, Sarjanrao Kapa¹, and Kailash MM², ¹*College of veterinary science, Tirupati, ANGRAU*, ²*University of Agricultural science, Bangalore*.

Body condition score (BCS) system is a subjective scoring method of evaluating the energy reserves of dairy cows which provide the better

reporting, via radio signals, of the GPS positional locations to an on-site computer. In addition to the animal GPS units, fixed GPS units were located at known locations within the pastures for additional data correction factors. In the summer of 2000, 16 crossbred steers were used to test the units and collect initial data. Data points were collected and transmitted to the on-site computer at one-minute intervals for a period of 28 hours, with 3108 data points collected on two steers. Battery life is affected by the data transmission interval, which may be set over a range of 10 second to 40 minute intervals. Costs for the cattle tracking GPS system, excluding labor for fabrication, were \$1000-\$1500 for the animal units (depending on the type of battery used), \$1300 for the DGPS base station, \$500 for the GPS position receiving base station, \$700 for fixed location GPS units, and the cost of a computer to download the data. This system allows for real-time monitoring of cattle grazing pastures at a lower price than commercially available units and should be useful for a wide variety of applications.

Key Words: GPS, Cattle, Grazing

1126 Effects of liquid supplement pH and acid source on liquid supplement intake of beef heifers and gestating beef cows. P.A. Davis¹, W.E. Kunkle¹, and J.D. Arthington², ¹University of Florida, Gainesville, ²UF-IFAS Range Cattle Research and Education Center, Ona, FL.

Effects of lowering pH of sugarcane molasses-based liquid supplements (MOL) on ad libitum supplement intake were evaluated in two experiments. For Exp.1, four treatments were a 16% crude protein MOL, pH 4.2 (T4.2) and T4.2 acidified to pH 3.4 (T3.4), 2.9 (T2.9), and 2.3 (T2.3) using feed grade phosphoric acid added at 3, 6 and 9%, respectively. Intakes of these supplements were compared using a 4 x 4 Latin square design with five crossbred beef heifers (273 to 386 kg initial BW) in each of four 1.8 ha bahiagrass pastures. Each treatment was offered ad libitum in 288 kg capacity tanks with one lick wheel. Each period of the Latin square was three wk long and MOL consumption was measured weekly. This 84 d experiment was conducted twice, at Gainesville (GNV) and Ona (ONA) locations, during Summer 2000. In Exp. 2, seven treatments included T4.2 and T4.2 lowered to pH 3.25 with hydrochloric (C), phosphoric (P) or sulfuric (S) acids creating treatments C3, P3 and S3, respectively; and to pH 2.30 with C, P and S creating treatments C2, P2 and S2. Seventy Angus beef cows (560 kg BW) were assigned randomly to 14 bahiagrass pastures divided into two replicates in a complete block design. Supplement consumed was measured weekly during an initial three wk period then treatments were reassigned to new pastures for a second three wk period in Fall 2000. In Exp.1, daily supplement consumption (DCON) for GNV averaged 2.58 kg (range 1.43 to 3.29 kg) and avg DCON for ONA was 1.93 kg (range 0.84 to 2.87 kg). Across both locations, DCON decreased 13% (P=.08) for T3.4, 30% (P<.01) for T2.9 and 64% (P<.01) for T2.3 compared to T4.2 (3.08 kg). In Exp. 2, DCON averaged 3.99 kg (range 2.55 to 5.38 kg) with decreases of 53, 38, 33, 30 and 18% (P<.02) from T4.2 (5.38 kg) for P2, S2, P3, C2, S3, respectively. DCON for C3 (4.89 kg) was similar (P=.13) to T4.2. Lowering pH of MOL was an effective method of reducing MOL consumption. Effectiveness of acid source varied, with P most and C least effective at similar pH.

Key Words: Beef Cattle, Molasses, Intake

1127 Effects of Plane of Nutrition on Milk and Weight Traits in Lactating Beef Cows. M. A. Johnson*, A. D. Herring, L. J. Hughes, and P. D. Bleick, *Texas Tech University, Lubbock, Texas*.

Twenty-eight lactating Angus cows were utilized to determine the effects of plane of nutrition on cow weight change, calf weight gain, milk yield, and milk composition (protein, fat, and somatic cell count (SCC)) from d 45 to 157 of lactation in 2000. Cows were randomly split into two groups (n = 14) and fed either a diet formulated to meet NRC maintenance requirements (MAINT) or one that exceeded maintenance requirements by 25% (MAINT125). Feed allotment was adjusted each 28 d period to reflect current cow weight and period of lactation. Diets consisted of a custom mixed protein/energy supplement and sorghum silage. Cows were machine milked every 28 d to measure milk yield, percent protein, percent fat, and SCC. Calves were separated from cows 16 h before milk collection, and cows and calves were weighed prior to milking. Data were analyzed as a repeated measures design with independent variables of diet, cow nested within diet, period, diet by period

interaction, calf sex, the regression on cow milk expected progeny difference (CEPD), and the regression on cow age in years; cow within diet was used to test diet effects. A time period effect (P < .01) was evident with all measured variables except SCC. Diet main effect was insignificant for all variables; however, a diet by period interaction was present (P < .05) for calf weight and milk protein. The interaction resulted because weight of MAINT125 calves was higher during the last three collection times when compared to MAINT calves, with a similar effect evident for milk protein. Calf sex (P < .01), CEPD (P = .047), and cow age (P = .048) additionally affected calf weight. CEPD ranged from -0.91 to 8.62 kg (3.63 kg average), and influenced milk yield (P < .01) and milk protein (P < .01). Average milk yields for collection times 1 through 5 were 5.4, 5.2, 4.8, 4.6, and 4.2 kg, respectively. Cow weight varied between collection times (P < .01) and was influenced by cow age (P < .01). Average initial (and final) weights for MAINT and MAINT125 cows were 577 (565) kg and 584 (581) kg, respectively. These data suggest that enhanced performance and milk composition does not result when Angus cows are fed 25% above maintenance requirements.

Key Words: Beef Cows, Milk Production, Weight

1128 Effects of feedbunk management strategies and monensin levels on feedlot performance in cattle fed to harvest. G.J. Vogel¹, J.C. Parrott¹, S.B. Laudert¹, and D.R. White¹, ¹Elanco Animal Health, Indianapolis, IN.

Two trials involving 3,408 crossbred steers with an average initial weight of 280 kg were conducted to evaluate the effects of different clean feedbunk times (i.e., targeted time for cattle to have consumed daily feed issue) and monensin levels on animal performance in cattle fed to harvest. Each trial consisted of 3 treatments with 6 replications. Treatments consisted of either a targeted clean feedbunk time of 0600 h with monensin included at 29 mg/kg of diet DM (T29), or a targeted clean feedbunk time 8 h earlier at 2200 h with monensin included at either 29 (C29) or 36 (C36) mg/kg of diet DM. Tylosin was fed throughout both trials to all cattle at 90 mg/d. Animals were fed twice daily at 0600 and 1300 h. Feedbunks were evaluated at 0600, 2000, 2200, and 0000 h for feed availability. Feed delivery was adjusted daily based on feedbunk readings. Cattle pen weights were obtained for each pen at the start of the trial, re-implant time, and at slaughter. All animals which died during the trial were necropsied. Data were analyzed as a randomized complete block design using pen as the experimental unit. Orthogonal contrasts were conducted to evaluate clean feedbunk time and monensin levels within clean feedbunk time. In trial 1, no differences in DM intake (7.81, 7.72, 7.73 kg), daily gain (1.31, 1.28, 1.32 kg/d) or final weight (505, 502, 509 kg) were noted among treatments T29, C29, and C36, respectively (P>.05). In trial 2, DM intake (8.83, 8.58, 8.51 kg), daily gain (1.52, 1.47, 1.46 kg/d) and final weight (557, 548, 548 kg) were reduced (P<.05) for cattle on the earlier clean feedbunk time at both monensin levels. Across both trials feed conversions were improved within the earlier clean feedbunk time with increased monensin level [5.92 (C29) vs 5.84 (C36); P<.05]. No differences in digestive death loss were observed among the treatments (.08%, .23%, .30%; P>.30). Results from these trials indicate that animal performance may be reduced if DM intake is compromised when an earlier clean feedbunk time is used. Feed conversions are also improved when higher levels of monensin are fed.

Key Words: Cattle, Monensin, Feedbunk Management

1129 Serum concentrations of trenbolone acetate and estradiol benzoate in cattle implanted with coated SYNOVEX Plus long-acting implants. L. A. Kraft¹, D. M. Henricks², S. Gray², A. N. Sinha¹, and K. L. Simkins¹, ¹Fort Dodge Animal Health, Princeton, NJ, ²Clemson University, Clemson, SC.

Commercial SYNOVEX Plus (SP) implants were coated (15% w/v) to extend the release of trenbolone acetate (TBA) and estradiol benzoate (EB) for about 200 days. Thirty Hereford crossbred steers (250-350 kg) were used to compare the serum concentrations of TBA and EB from coated Long-Acting (LA) and SP implants in cattle for 200 days. The cattle were blocked by pretreatment body weight and randomly assigned to one of the two implant groups within each block. All animals received either a LA implant or a SP implant in one ear. All implanted cattle were maintained together on pasture and supplemented daily with 1-2 kg/hd of a 16% crude protein concentrate. Ears were examined on Days 1, 4, 7, 14, 21, 28, 42, 56, 70, 91 and 112 for inflammation and presence of implants. Implants were detected in all animals through Day 70, but

could not be detected with certainty after Day 70 due to the normally expected depletion and decrease in size. Implant site reactions were minimal. Blood samples were obtained from the contralateral jugular vein on Days -2, -1, 0, 1, 4, 7, 14, 21, 28, 42, 56, 70, 91, 112, 133, 154, 175 and 200. Serum samples were assayed for trenbolone-17 β (TBOH) and estradiol-17 β (E₂), the active metabolites of TBA and EB. Serum TBOH for the LA implant was lower (P<0.10) than for the SP implant on Days 1-42 and higher (P<0.10) on Day 133. Similarly, serum E₂ was lower for the LA implant on Days 7-56 and higher on Day 133. The areas under the curve (AUC), the maximum analyte concentration (C_{max}) and time at which it was observed (T_{max}) were calculated. There were no differences (P>.10) in C_{max} for the LA and SP implants (317±37 vs. 347±33 pg/ml for TBOH and 12.5±1.8 vs. 11.3±0.9 pg/ml for E₂). However, the T_{max} for TBOH was 55±13 days for the LA implant compared to 19±4 days for the SP implant. The respective T_{max} values for E₂ were 122±14 and 44±8 days. The AUC for serum TBOH was lower (P≤.10) for the LA implant than for the SP implant suggesting that the coated LA implant was not completely depleted by Day 200 when serum TBOH was 13.7 pg/ml compared to 1.6 pg/ml for the SP implant. In summary, coating the commercial SYNOVEX Plus implant significantly reduced the early release of TBA and EB resulting in an extended release implant that lasted approximately 200 days.

Key Words: Beef Cattle, Trenbolone Acetate, Estradiol Benzoate

1130 Factors affecting net value of feedlot steers. N.K. Grathwohl¹, W.B. Epperson¹, B.J. Johnson², and S.W. Fausti¹, ¹South Dakota State University, ²Kansas State University.

Data from 874 steers enrolled in South Dakota State University's Calf Value Discovery (CVD) Program (1998 and 1999) were used to investigate factors affecting net value of feedlot steers. This analysis was conducted to evaluate how ranch of origin management (ROM) and feedlot health impact economic value. An OLS regression procedure was employed to analyze the data. The dependent variable, net value, was defined as: carcass revenue - feedlot cost. Overall fit of model was good as indicated by coefficient of determination R²=.9569. Regression results for health and ROM factors affecting net value is provided in the table below. Factors in the table are defined as: a) prewean was a categorical variable whose value was dependent on the days from weaning to feedlot entry - 0=if steers were weaned 0-3 d before entry, 1=if steers were weaned 4-14 d before feedlot entry, 2=if steers were weaned 15-29 d before feedlot entry, 3=if steers were weaned 30-44 d, and 4=if steers were weaned > 45 d before feedlot entry; b) modified live vaccine - if calf received a modified live viral IBR/BVD/BRSV/PI3 vaccine prior to feedlot arrival; c) in weight - weight (kg) of the calf at arrival to feedlot; and d) respiratory illness - if calf was treated for respiratory illness in feedlot. Results from this study found respiratory illness at the feedlot reduces net value of feedlot steers, while use of a modified live vaccine and preweaning at the ranch increases net value along with in weight. As anticipated, these factors contributed relatively little to overall net value. However, these data suggest ROM and health can impact the net value of feedlot steers at harvest. A more thorough understanding of these factors may help producers increase the net value of their product.

Factors	Parameter			
	Estimate	SE	Partial R ²	P-Value
Prewean	1.9698	.9560	.0003	.0398
Modified Live Vaccine	13.5639	2.2133	.0032	.0001
In Weight (kg)	1.2625	.0263	.1639	.0001
Respiratory Illness	-22.0417	3.6710	.0027	.0001

Key Words: Beef Cattle, Management, Health

1131 A systems approach for adding value to Montana feeder calves. D. J. Fennewald*, J. A. Paterson, R. N. Funston, and L. P. Anderson, *Montana State University-Bozeman Bozeman, MT.*

ABSTRACT: Two thousand eight hundred ninety-eight calves from 12 ranches were individually identified to evaluate if a standardized weaning protocol following prescribed vaccinations, nutrition and 45-d of backgrounding could reduce morbidity from weaning to harvest. Freshly

weaned calves were allocated to 1) CONTROL (defined as present weaning practices which may or may not provide pre-weaning vaccinations and do not retain calves for 45 d after weaning) or 2) TREATMENT (calves fed either 1.82 kg/d of a pellet or 0.45 kg/d of liquid supplement for 28 d containing additional levels of Cu, Zn, Mn, CP, vitamins A and E and a coccidiostat). Ranches chose viral and clostridial vaccines (MLV or killed) and described pre- and post-weaning management. Calves were fed in six states. Seven of the ranches divided calves into control and treatment groups (826 and 855, respectively) while three ranches had only treatment (n = 835) and two ranches had only control (n = 382). Results suggested calf morbidity was reduced (P<0.05) for calves backgrounded for 45-d or longer compared to calves backgrounded less than 45 d (6 vs. 21%). Death loss was lower (P<0.001) for 45-d backgrounded calves (0.3%) vs. 2.4% for calves backgrounded less than 45-d. Although not significant (P=0.17) calves fed the treatment pellet appeared to numerically have lower morbidities from weaning until harvest (6.3%) compared to control calves (19.5%). Range in morbidities was 0-100% for control vs. 0.5-20.9% for treatment. Boosting vaccinations appeared to help reduce (P=0.18) morbidity in the feedlot (7.4% for calves that received boosters vs. 21% for calves that received a single vaccination). Carcasses from six ranches were priced the week of harvest to compare gross income when priced as a base carcass price, on a quality or on a yield grade grid. Carcass weight correlations to gross income were 0.939, 0.838 and 0.926 when priced as a base carcass price, on a quality or on a yield grade grid, respectively (P<0.0001). Morbidity and death loss may be reduced when a weaning management strategy includes nutrition, proper vaccination and 45-d backgrounding. Carcass weight was highly correlated to gross income by marketing heavier carcasses that did not exceed industry specifications.

Key Words: Beef cattle, Weaning, Morbidity

1132 Predicting nutrient balance in the feedlot. H. Fairweather, K. A. Beauchemin, and K. M. Koenig, *Agriculture and Agri-Food Canada, Research Centre, Lethbridge, AB, Canada.*

There is a one-time feeding capacity of over 1,000,000 head of beef cattle in a 70,000 ha area in Southern Alberta. Therefore, there is a potential for nutrients to cease being an asset to the production system and become a liability to the environment. A whole system model (FeedNuts) is being developed to predict the nutrient balance in the feedlot by means of a daily time step stochastic simulation. The model was run for a 1000 head feedlot; cattle were fed a ration of 90% barley grain, 6% barley silage and 4% canola meal (DM basis). Initial weight of the cattle was 350 kg, final weight was 575 kg, and the feeding period was 150 d. Predicted N intake in the feedlot for the entire period was 38.1 t and the predicted P intake was 6.9 t. At the end of the simulation there was 1.7 t of soluble N and 9.1 t of insoluble N in the manure stockpile. A total of 14.9 t of N was volatilized from the manure (5.8 t during the time the animals were in the feedlot and 9.1 t in the 4 months the manure was stockpiled), 7.3 t was lost in runoff, all of which was volatilized from the holding pond. No P was lost to volatilization, however 0.2 t of P was lost in runoff and the manure stockpile contained 0.3 t soluble P and 5.5 t of insoluble P. This resulted in manure containing 3.0% total N and 1.6% total P (DM basis). Most crops take up from 5 to 13 times the amount of total N to total P and, therefore, if this manure was applied to a cropping system to meet the N requirement, P would accumulate in the soil. The system becomes more unbalanced if the losses of N in the soil are compared with the relatively small losses of P. Another complicating factor is the percentage of each of the nutrients in the applied manure that is available for crop uptake. The FeedNuts model simulates each of the pathways and changes in the nutrients as a function of different rations and provides a mechanism for investigating the nutrient balance at any point in time by conducting 'virtual' experiments. These experiments predict considerable variation in the soil nutrient balance for different rations.

Key Words: Nutrient balance, System model, Simulation

1133 Farm-level management practices of cattle: Effects on Enterohemorrhagic *Escherichia coli* and *Salmonella* in feedlot cattle. A.D. Herring¹, A.R. Barham*¹, S.K. Misra¹, C. Akers¹, and J.R. Blanton Jr.¹, *Texas Tech University, Lubbock TX.*

The objective of this study was to generate preliminary evidence to investigate the potential that farm-level management of cattle may affect

shedding of Enterohemorrhagic *Escherichia coli* (EHEC) and *Salmonella* (SAL) in the feedlot. Cattle from 5 climatic/geographical origins within Texas were studied. Management practices were: origins 1, 2, 3 and 4 utilized stocker-managed cattle, whereas origin 5 utilized backgrounded animals. Origins 1 and 3 employed an implant during the pre-feedlot period. Animals from origin 1 were 25% Brahman-25% British-50% Continental, origins 2 and 5 were 25% Brahman-75% British; origin 3 were 50% British-50% Continental and origin 4 cattle were 100% British. Steers composed all treatment groups except 9 heifers in origin 2. Fecal grab samples were collected prior to and following shipment to feedlot, on day 56 of the feedlot period, and prior to and at the slaughter facility. On arrival at the feedlot, cattle (n = 84) received clostridial and respiratory disease vaccinations, pour-on insecticide, and were assigned to pens (n = 6 anim) blocked by origin. Diets consisted of a corn-based grower/finisher ration that exceeded NRC requirements. Fecal grab samples were collected pre- and post-feedlot arrival, on day 56 of the feedlot period and pre- and post-exsanguination. EHEC and SAL prevalence were evaluated utilizing FSIS approved protocols. Pen was experimental unit with percent incidence analyzed using GLM procedures with a model that included origin, time, pen (origin) and origin*time interaction. EHEC levels were effect by origin (P < .05). Origin 4 had the highest incidence level of EHEC shedding (20.3%), whereas origin 3 had the lowest incidence (2.5%). While there were not any significant origin or time main effects for SAL, there was an origin*time interaction (P < .05). SAL incidence increased over time for origins 2 and 4, but decreased for origins 1, 3 and 5. Overall, these data indicate that cattle origin (location, management etc.) can result in different level of EHEC and SAL shedding in feedlot cattle.

Key Words: Salmonella, Escherichia coli, Cattle

1134 The Effect on Economics of Integrating Pasturing Systems into Cattle Finishing Programs. H Koknaroglu*¹ and M.P. Hoffman¹, ¹Iowa State University.

A three-year study, using 84 fall-born and 28 spring-born calves of similar genotypes each year, was conducted to integrate pasturing systems with drylot feeding systems. Fall and spring-born calves were started on test in May and October, respectively. Seven treatments were imposed: 1) fall-born calves directly into feedlot; 2 and 3) fall-born calves put on pasture with or without an ionophore and moved to the feedlot at the end of July; 4 and 5) fall-born calves put on pasture with or without an ionophore and moved to the feedlot at the end of October; 6 and 7) spring-born calves put on pasture with or without an ionophore and moved to the feedlot at the end of October. A 12.1 ha bromegrass pasture divided into 16 paddocks was available. Each treatment group had access to one paddock at a time and was rotated approximately at 3 day intervals. In the feedlot, steers were provided an 82 % concentrate diet containing whole-shelled corn, ground alfalfa hay, a protein, vitamin and mineral supplement containing ionophore and molasses. When pens of cattle reached approximately 522 kg average live weight, they were processed and carcass traits were evaluated. Overall, cattle started directly in the feedlot gained faster (P<0.001). Treatment influenced yield grade (P<0.001), however all treatments were YG 2. All treatment groups graded 75 % Choice or higher. Cattle started directly in the feedlot were the least profitable (\$-16 vs \$27; P<0.001). Cattle not receiving ionophore on pasture were a little more profitable (\$29 vs \$25; P>0.7), except fall-born cattle moved to the feedlot in October (\$22 vs \$30). Feeder and carcass prices were the two most important variables explaining the variation in profitability. These results indicate that cattle fed on pasture for varying periods of time produced acceptable carcasses and that feeder and carcass prices were the two most important variables affecting profitability. Thus, the timing of marketing is critical for optimizing profit.

Key Words: Steers, Feedlot, Pasture, Economics

1135 Repeated administration of implants to Holstein steers increases average daily gain, longissimus muscle area and the percentage of USDA Select carcasses. J.M. Scheffler*, D.D. Buskirk, S.R. Rust, J.D. Cowley, and M.E. Doumit, Michigan State University, East Lansing, MI.

The objective was to determine the effect of repeated use of implants on feedlot performance and carcass characteristics. Holstein steers (n=128) weighing an average of 211 kg were blocked by weight and randomly assigned to 16 pens. At the initiation of the trial (d 0), pens were assigned

to one of four treatments: non-implanted control (C), implant on d 0, d 100 and d 200 (I3), implant on d 100 and d 200 (I2) and implant on d 200 (I1). ComponentTM TE-S implants (120 mg trenbolone acetate and 24 mg estradiol per implant) were used for all treatments during the 268-day feeding period. During the first 200 d of trial, implanted steers had higher ADG compared to non-implanted steers (P<.01). Only I1 steers had greater ADG than C during the last 68 d (P<.05). Steers were harvested at a commercial abattoir on d 269. Hot carcass weights of I2 and I3 were similar to each other and greater than C and I1 (P<.05). Dressing percentage, adjusted 12th rib fat, percent kidney, pelvic and heart fat, yield grade and CIE L*a*b* values were not different between treatments. Longissimus muscle areas (LMA) from I2 and I3 were larger than LMA of C (P<.01). No USDA Select carcasses were produced from control cattle, while the percent Select from implanted cattle ranged from 9-17%. Repeated administration of ComponentTM TE-S implants improved ADG and resulted in heavier carcasses with larger LMA, but increased the percentage of carcasses grading USDA Select.

Key Words: Implants, Holstein, Average daily gain

1136 Effects of pre and/or postpartum fat supplementation on reproduction in mature beef cows. S.K. Johnson*, J.S. Stevenson, K.R. Harmony, and J.R. Brethour, Kansas State University.

The objective of this study was to determine the effects of level of supplemental fat either prepartum, postpartum or both on reproduction in beef cows fed a sorghum-sudan hay base diet. Multiparous crossbred cows (n=269) received a low fat milo-based supplement (2% EE, 18% CP; 2.7 kg/hd/d; LF) or a high fat sunflower-based supplement (26% EE, 18% CP; 1.6 kg/hd/d; HF) either prepartum (PRE) or postpartum (POST) in a 2 x 2 factorial arrangement of treatments. Sorghum-sudan hay was offered ad libitum and ranged in quality from 5 -12% CP. The lowest quality hay was fed prepartum. Mean length of supplementation was 64 d PRE and 76 d POST and continued through a 5-d AI period. Two blood serum samples were collected 14 d apart just before administering 25 mg of PGF_{2α} to synchronize estrus. At the end of the AI period, cows were transported to summer pastures and exposed to bulls for 53 d beginning 9 d after transport. No effect of type of supplement fed PRE was observed for reproductive measures. In contrast, the proportion of cows cycling at the beginning of the breeding season (74% vs 65%) and the pregnancy rate to AI (44% vs 32%) was greater (P<.05) for cows receiving LF as compared to HF POST, respectively. Level of fat supplementation had no effect on pregnancy rate for the entire breeding season (95.4%). Cows fed LF POST had a higher body condition score (BCS) at breeding (5.2 vs 4.7), lost less BCS from calving to breeding (-0.3 vs -0.6) and weighed more at breeding (497 vs 482 kg) than HF cows, respectively (P<.05). There was no difference in cow weight or BCS at weaning due to treatment; however, cows receiving HF POST gained condition from breeding to weaning while LF cows lost condition during the same time period. Calf birth weight, calving difficulty score, and calf weaning weight did not differ due to treatment. Increased supplemental fat fed prepartum, postpartum, or both did not improve reproductive traits of mature cows in a herd already in good body condition and with high reproductive performance.

Key Words: Cows, Fat supplementation, Pregnancy rate

1137 Comparison of pregnancy rates in beef cows for two synchronization regimens using GnRH, PGF_{2α} and MGA. W.A. Greene and M.L. Berger*, The Ohio State University, Wooster USA.

Seventy-seven beef cows were allotted to two similar groups based upon breed, age, postpartum interval, and postpartum cyclicity (as determined by ultrasonography) to compare pregnancy rates (PR) resulting from two synchronization regimens using GnRH, prostaglandin F_{2α} (PGF_{2α}), and melengesterol acetate (MGA). Both groups received 50 μg GnRH i.m. on d 0 and 25 mg prostaglandin F_{2α} (PGF_{2α}) i.m. on d 7. Group 1 was fed MGA from d -26 to d -12 at a rate of .5 mg/cow/d. These cows were observed for estrus 0700 and 1900 and were artificially inseminated (AI) 8-16 h after estrus was observed or 80 h after PGF_{2α} if estrus was not observed. Group 2 was fed MGA (.5 mg/cow/d) from d 0 to d 6, received a second GnRH i.m. on d 9 (48 h after PGF_{2α}), and were AI 16 h after the d 9 GnRH injection. Following the synchronization period, repeat breedings were done until d 58. Cows were

pregnancy diagnosed by ultrasonography on d 84. PR to synchronization (PR-SYNC) and overall PR were similar for both groups ($P > .05$). PR-SYNC for Groups 1 and 2 were 59.5 and 55.0%. Overall PR for Groups 1 and 2 were 94.6 and 87.5%. PR-SYNC tended to be higher for cycling cows (61.7 vs. 41.2%, $P = .17$) while overall PR was not affected ($P > .05$) by postpartum cyclicity status at time of synchronization.

1138 Predicting resistance to compression of wool fibers. F.A. Pfeiffer*, C.J. Lupton, and B.A. Kuykendall, *Texas Agricultural Experiment Station, San Angelo, Texas/USA.*

Resistance to compression (RTC) is the force per unit area required to compress a fixed mass of wool to a fixed volume. Units of measure are kilopascals (kPa). Together with other important characteristics such as staple length (SL) and average fiber diameter (AFD), RTC is used to predict processing and product performance of wool, this being part of the value determining process for some raw wools. Objective measurement of RTC requires several preparation steps (washing, drying, carding, and conditioning) and a specialized testing apparatus not generally available in U.S. wool testing labs. On the other hand, fiber diameter distribution is now routinely measured by fast, accurate, high-tech instruments. Recently, the capabilities of one such instrument, the Optical Fiber Diameter Analyser, were expanded to include concurrent measurement of fiber diameter and fiber curvature (FC) distributions. One hundred and four samples representing a broad cross section of commercially available wools were quantified individually using standard methods for SL (mean = 9.6 cm, range 6.1 to 18.2 cm), AFD (24.1, 18.0 to 43.1 μm), FC (82.9, 20.0 to 121.1 degrees per cm), clean yield (CY; 67.1, 41.4 to 88.7 %), vegetable matter content (VM; 1.6, 0.1 to 6.7 %), crimps per unit length of staple (CR; 3.9, 0.7 to 7.0 crimps per cm), and RTC (9.1, 6.7 to 13.1 kPa) in order to study the relationships between RTC and the other measured traits. Resistance to compression was shown to be significantly ($P < 0.05$) but not highly correlated with SL, AFD, FC, CY, and CR ($r = -0.36, -0.21, 0.57, -0.52, \text{ and } 0.42$, respectively). As expected, FC was highly correlated with CR and AFD ($r = 0.94$ and -0.83 , respectively). Stepwise multiple regression analysis was used to predict RTC using all the measured variables (and their SD values for all traits except CY and VM). The resulting equation was $\text{RTC} = -2.13 + 0.22 \cdot \text{AFD} + 0.07 \cdot \text{FC}$, $r^2 = 0.54$. No other variables met the 0.01 significance level for entry into the model. We concluded that for textile applications in which a specific RTC is required, it still will be necessary to measure this characteristic directly because it cannot be accurately predicted using other raw fiber traits.

Key Words: Wool, Resistance to compression, Fiber traits

1139 Evaluation of forages for outdoor gestating sows. H. A. Rachuyoonyo*¹, V. G. Allen¹, J. L. Morrow-Tesch², J. W. Dailey², and J. J. McGlone¹, ¹*Texas Tech University, Lubbock*, ²*USDA-ARS, Lubbock*.

Sustainable outdoor pig production requires vegetation that can maintain ground cover, take up manure nutrients, and prevent soil erosion. Two studies were conducted using 4 forages, alfalfa (*Medicago sativa*), tall fescue (*Festuca arundinacea*), white clover (*Trifolium repens*) and buffalograss (*Buchloe dactyloides*). Individual plots of single forage covered about 6 m². In first study, 8 pregnant gilts were given free access to 4 blocks of forages during a 2-d adjustment period and then gilts (2 per block) were assigned randomly to four blocks of 4 forages. Percentage ground cover was visually estimated at time 0, 24, and 48 h of study and analyzed as a split plot. Behavior data including walking, eating, grazing, rooting, drinking, standing, lying, and time-spent in-hut were monitored continuously by camera for 48 h. Percentage ground cover, which started at 100%, was reduced ($P < .01$), especially for clover (48.70.63%) and alfalfa (62.50.63%) but not for fescue (98.70.63%) or buffalograss (98.70.63%). In a second study, six gilts from the initial group were used; each one was assigned randomly to individual forages. Clover was excluded in second study because of damage by gilts during first phase. Rate of loss for percentage ground cover was higher ($P < .01$) for alfalfa than buffalograss or fescue (-31.3, -1.7, -1.8%/d, respectively) in second study. Behavioral analysis in first study showed that sows spent more ($P < .01$) time grazing clover (16.3 1.97 min) and alfalfa (11.2 1.97 min) than fescue (.81.97 min) or buffalograss (.31.97 min), and rooted more ($P < .04$) clover than other forages. In second study, gilts spent more ($P < .01$) time grazing alfalfa (15.82.36 min) than buffalograss (1.52.36 min) or fescue (0.72.37 min). Pigs have clear preferences for grazing alfalfa and clover, and rooting clover. Rates of loss of ground cover were

lower for fescue and buffalograss than other more preferred forages and, thus, these forages may have potential in pastures for swine to provide ground cover. Longer-term studies are needed.

Key Words: Pig, Environment, Forage

1140 Improving the viability of piglets with oxygen. J Zhang, V Osborne, M Fan, and R Hacker*, *Dept. of Animal & Poultry Science, University of Guelph, Guelph, Ontario Canada N1G 2W1.*

The objective of this study was to improve piglet viability and to reduce piglet mortality during the first 7 d of life with oxygen treatment. Two chambers (51x28x30.5cm) were purchased from a retail fish aquarium shop. The treatment chamber was fitted with a lid, an oxygen port and a monitoring port. Oxygen was supplied to the treatment chamber via a controller (#1630 Engineered Systems & Designs) which was connected to a mobile oxygen tank. Piglets (231) received oxygen immediately after birth or were maintained (232) in an identical control chamber with no supplemental oxygen. Temperature in both chambers was kept between 31 and 35°C and no more than three piglets occupied a chamber simultaneously. Oxygen content in the chamber was verified with a Stat Profile Plus-9 Component of NOVA Biomedical Canada Ltd. The movement of the piglets' front legs was counted in the first 20 s after removal from the chamber. Piglet BW was recorded at the birth and at d 7, with the difference used to calculate gain. Total mortality during the first 7 d of life was compared with 974 background piglets that were farrowed during the experimental period in the herd, with little or no attention during farrowing. Data were analyzed by the GLM procedure of SAS. Oxygen inhalation for 10 min improved ($P < 0.05$) piglets' movement and weight gain compared with the 10-min control group. However, there was no difference ($P > 0.05$) between the 15-min groups. Cumulative mortality of all experimental groups during the first 7 d after birth was lower ($P < 0.01$) than that for the background group. This was especially true for the 10-min oxygen group, which was lower ($P < 0.01$) than the background group by 88.0% during the first 3 d of life (0.8 vs. 6.9% on d 1 and 0.8 vs. 8.0% at d 3). It can be concluded that providing 10-min of oxygen immediately after birth increases piglet viability and growth during the early postnatal period.

Key Words: Oxygen, Temperature, Mortality

1141 The impact of farrowing crate design on litter performance traits in swine. S.J. Moeller*, K.M. Irvin, K.R. Black, and S.M. Neal, *The Ohio State University, Columbus, OH.*

Litter records representing 1,249 multi-parous females were used to evaluate the impact of farrowing crate design on litter, piglet and sow performance traits. Five farrowing crate designs with variability in lower bar design, width of crate and orientation within farrowing pen were compared. The crate designs were: B1, 188 x 42 cm, finger side; B2 188 x 47 cm, finger side; K1, 185 x 42 cm, finger side; K2 185 x 42 cm, bow-bar side; and Z, 197 x 42 cm, finger side. Total farrowing pen space was 213 x 152 cm for B1, B2, K1 and K2, and 213 x 137 cm in the Z-crate. The Z-crate was placed diagonally within the pen and pen size was smaller by design. Farrowing crates were randomly placed with sows randomly assigned to crates upon entering the farrowing facility. Subsets of crate-type were evaluated in statistical models to evaluate crate width (narrow vs wide), lower-bar type (finger vs bow-bar), or manufacturer type. Statistical analyses were performed using mixed model procedures of SAS, with a random effect of farrowing group and fixed effects of parity, female breed and crate characteristic. Interactions were tested. Covariates were used to standardize litter traits to a 21 d lactation length where appropriate. Twenty-four dependent variables were evaluated encompassing birth and weaning numbers, survival rates, litter weights, female weight loss and fat loss. Results comparing B1 vs B2 (narrow vs wide) finger crates (N=627) revealed no differences in pig, sow, or litter measures. Litters raised in bow-bar crates (K2, N=269) were found to have significantly ($P < .05$) more pigs (.34 pigs/litter) and heavier litter weight (2.18 kg/litter) at 21 d than finger-crates (K1, N=186). The number of pigs dying within 1 d of birth was significantly higher ($P < .05$) in the Z-crate (0.80 pigs) when compared to the K1 crate (0.54 pigs), but no differences were found in number of pigs weaned at 21 d. Parity and female breed effects were significant for most traits measured. In this study crate width did not impact sow or

litter performance. However, bow-bar crate type resulted in more pigs and heavier litter weights at 21d.

Key Words: Swine, Farrowing, Litter

1142 Supplemental feeding lactating Fallow does increased body condition score and circulating leptin but failed to improve reproductive efficiency. K. C. Candler^{*1}, C. G. Brown¹, D. A. Neuendorff¹, A. W. Lewis¹, J. A. Sterle², D.H. Keisler³, and R. D. Randel¹, ¹Texas Agricultural Experiment Station, Overton, ²College Station, ³University of Missouri, Columbia.

Gestating does (*Dama dama*); (BW=51.3kg) were allotted into groups: 1) Control (C; No Supplement n=12), 2) Supplement (S; 4:1, corn:soybean meal n=12), or 3) Rice Bran (R; 3:1:1, corn:soybean meal:20% fat rice bran n=12) formulated to be isonitrogenous and isoenergetic and grazed Coastal bermudagrass/ryegrass pastures. S and R were fed .5kg ration/head/day for 112d. All does were weighed, body condition scored (BCS), and blood sampled at 7d intervals for 14d prior to and for 35d after weaning. Serum progesterone (P4) and leptin concentrations were determined using RIA. Pregnancy was determined by ultrasonography 30 and 75 d after buck exposure. S does tended (P<.075) to lose less weight (-.062±.004kg/d) than C (-.073±.004kg/d) or R (-.071±.004kg/d). C does tended (P<.08) to have lower BCS than R but were lower (P<.002) than S. S does lost less (P±.001) BCS (-.636±.310) than C (-2.167±.297) with R being intermediate (-1.432±.310). Fawn birth weights did not differ (5.2±.2kg/d, 5.1±.2kg/d, 5.3±.2kg/d; C, S, and R, respectively). C fawns had the lowest (P<.003) ADG (.128±.010kg), S the highest (.185±.010kg) and R intermediate (.162±.010kg). Serum leptin (ng/ml) increased over time (P<.001) and differed by treatment (P<.06) with S being the highest and C and R being similar (P<.10) and lowest. Preweaning P4 was higher (P<.003) in S (2.4±.2ng/ml) than either C (1.5±.2ng/ml) or R does (1.7±.2ng/ml). 100% of S does were estrous cycling before weaning compared with 66% of C and 75% of R. Postweaning P4 increased over time (P<.0001) but was not affected by treatment (P>.10). By d 30 of the breeding season, 100% of S does were pregnant compared with 91% of C and R and all does were pregnant by d 75. Inclusion of rice bran failed to improve performance but supplement corn and soybean meal supplement increased

BCS and circulating leptin. Weaning and buck exposure resulted in equal breeding performance in thinner does.

Key Words: Rice bran, *Dama dama*, Dietary energy

1143 Angus steer performance grazing bermudagrass on degraded soils fertilized with poultry litter, ammonium nitrate, or crimson clover. D. H. Seman^{*1}, J. A. Stuedemann¹, and A. J. Franzluebbers¹, ¹USDA-ARS, Watkinsville, GA USA 30677.

We have been investigating the impact of using cattle in forage systems to restore degraded cropland in the Southeastern US. The object of this study was to evaluate performance of steers grazing bermudagrass pastures that were fertilized by three fertilizer treatments and were stocked at two grazing pressures. Yearling Angus steers were randomly assigned to 18 paddocks (.65 to .75 ha) which were organized in three blocks. Three nitrogen (N) treatments included N provided as ammonium nitrate (M), poultry litter (L) or by crimson clover plus ammonium nitrate (C). Ammonium nitrate and L were applied twice each year to annually provide 200 kg N/ha. Cattle grazed for 140 days from mid-May until mid-October for five years. The high grazing pressure (HP) was to maintain 1,500 kg forage/ha and low grazing pressure (LOW) maintained 3,000 kg/ha with a differential of 1,500 kg/ha between both rates. Stocking rates were adjusted every 28 days by put-and-take. After five years, the M treatment had greater average total grazing days (1,092) than C (926) and L (944), (P<.05). The L treatment had less total animal gain/ha, 607 kg/ha than did M (733 kg/ha) and C (688 kg/ha) treatments (P<.05). Average daily gain (ADG) was greater for C (.78 kg/d) than L (.69 kg/d) (P<.05) with M intermediate (.74 kg/d). Steers grazing HP had 1,118 grazing days vs. 857 LOW (P<.05). Steers grazing HP had greater total animal gain/ha, 732 than LOW with 620 kg/ha (P<.05). Steers grazing LOW had greater ADG .82 kg/d than HP .65 kg/d (P<.05). Steers exhibited excellent gains while grazing bermudagrass during summer. Poultry litter supported acceptable steer production even though animal production was less than M and C. Soil organic carbon was positively correlated with grazing days $r=.49$ (P=.0378). Results imply that grazing cattle can be employed to restore eroded cropland.

Key Words: Poultry Litter, Beef Cattle

ASAS/ADSA Animal Behavior and Well Being

1144 Quiet handling of heifers reduces aversion to restraint. V. Littlefield¹, T. Grandin¹, and J. L. Lanier^{*1}, ¹Colorado State University.

On eight non-consecutive days, 192 Hereford x Charolais heifers were restrained in a scissors type, hydraulic squeeze chute. Squeeze chute temperament and balking behavior was scored with 4-point scales. Squeeze chute temperament scores were 1= calm, stood still, 2 = struggled once, 3 = struggled multiple times, flexed shoulder muscles, and 4 = violent and consistent struggling. Balking behavior at the squeeze chute entrance was 1= entered chute without hesitation, 2 = Hesitation, moved into chute after being touched, 3 = Hesitated, tail twisted, and 4 = electric prod used. Gentle and quiet handling was maintained during all handling of the cattle, for all days. Squeeze chute and balking scores decreased with repetitive handling (P < .01). Mean squeeze chute score was reduced from 1.94 to 1.39 during the eight days. Balking before entering the squeeze chute was reduced from a mean of 1.89 on day one to a mean of 1.58 on day eight. Heifers with higher temperament scores typically entered the squeeze chute last (R2=.84, P<.01). Gentle, repetitive handling of cattle decreases balking in the handling facility and decreases reactivity to restraint in a squeeze chute. Cattle became easier to move into the squeeze chute with each successive handling.

Key Words: Cattle, Behavior, Temperament

1145 Genetic determination of maintenance behavior of calves. Jan J.J. Broucek^{*1}, Ted H. Friend², Clive W. Arave³, Paul Flak¹, Stefan Mihina¹, Michael Uhrincat¹, Anton Hanus¹, and Peter Kisac¹, ¹Research Institute of Animal Production, Nitra, Slovakia, ²Texas A&M University, College Station, USA, ³Utah State University, Logan, USA.

We assessed 21 Holstein calves (12 males and 9 females) descended from 3 bulls (AMS1, n=6; STB9, n=8; PEL2, n=7). The calves were kept in loose housing. We conducted three observations of maintenance behaviour, at 14 (A1), 16 (A2) and 19 (A3) weeks of age. The general activity of each of the animals was recorded at 10 min intervals over 24 hours. A significant effect of sire was found in the number of standing bouts (AMS1=36; STB9=38; PEL2=40, P<.05); a significant effect of gender in the time of lying (832 min males vs 802 min females, P<.05) and standing (608 min males vs 638 min females, P<.05), in the number of bouts when lying on the right side (20.1 males vs 18 females, P<.05) and standing (37.6 males vs 39.3 females, P<.05). The effect of age was highly significant in the time spent lying (A1=750 min; A2=826 min; A3=881 min, P<.01), in the time spent lying while ruminating (A1=325 min; A2=416 min; A3=450 min, P<.01), in the time of lying on the right side with rumination (A1=136.7 min; A2=157.6 min; A3=172.4 min, P<.01), in the time of standing (A1=690 min; A2=613 min; A3=559 min, P<.01), ruminating (A1=336 min; A2=442 min; A3=475 min, P<.01) and feeding (A1=289 min; A2=397 min; A3=327 min, P<.01), in the number of bouts lying while ruminating (A1=12.4; A2=15.8; A3=16.3, P<.01), number of bouts lying on the left side with rumination (A1=6.6; A2=8.8; A3=9, P<.01) and in the number of ruminating periods (A1=13.9; A2=18; A3=18.7, P<.01). A significant effect of age was found in the number of lying bouts on the right side (A1=17; A2=20.6; A3=20, P<.05). Significant interactions for sire x gender were found in the number of standing bouts (P<.05),