932 Effect of conjugated linoleic acids (CLA) on parameters of adipose tissue metabolism in the lactating dairy cow. L.H. Baumgard*, B.A. Corl, S.S. Block, D.A. Dwyer, Y.R. Boisclair, and D.E. Bauman, *Cornell University, Ithaca, NY*.

CLA have profound impact on lipid metabolism. Feeding CLA at 1-2% of the diet dramatically reduced body fat content in growing mice, rats and pigs. Effects are also observed in lactating dairy cows where CLA at 10 to 20-fold lower concentrations markedly reduces milk fat synthesis. This reduction in milk fat is specific for the *trans*-10,*cis*-12 CLA isomer and shifts milk fat composition toward greater proportions of long chain fatty acids. The mechanism(s) by which CLA affects lipid metabolism is not clear, but postulated effects have included increased lipolysis. Our objectives were to evaluate the effects of CLA isomers on circulating concentrations of nonesterified fatty acids (NEFA) and the lipolytic response to a β-adrenergic challenge. We also evaluated circulating leptin given the reported role of this signal in storage and use of energy. Three multiparous Holstein cows (183 ± 8 DIM) were utilized in a 3x3 Latin square design. Treatments consisted of 5-d abomasal infusion of 1) control, 4L of skim milk/d, 2) 9,11 CLA, 10 g/d of *cis*-9,*trans*-11 CLA isomer and 3) 10,12 CLA, 10 g/d of *trans*-10,*cis*-12 CLA isomer. Basal concentrations of NEFA were determined on d 4. Epinephrine challenges (1.4 μg/kg body weight) were intravenously administered at 9:00 am and 3:00 pm on d4. Plasma samples (n=19) were obtained from a jugular catheter and area under the NEFA response curve (0 to 30 min, AUC) was quantified after correcting for basal concentrations. Basal NEFA concentrations (139 μmol/l) were not altered by treatment. NEFA response to epinephrine challenge was effected by treatment being reduced by 39% for the 10,12 CLA as compared to the other treatments(P<0.05). Treatments had no effect on plasma leptin concentrations which averaged 3.1 ng/ml. Overall, data demonstrate that the *trans*-10,*cis*-12 CLA isomer which caused milk fat depression had no chronic effect on NEFA concentrations (basal lipolysis) or circulating leptin concentrations, but did give a modest reduction in the lipolytic response to an epinephrine challenge.

Key Words: CLA, NEFA

933 Acute nutritional restriction alters endocrine function and causes anovulation in beef heifers. F.J. White*, C.A. Lents, L.N. Floyd, L.J. Spicer, and R.P. Wettemann, *Oklahoma Agricultural Experiment Station, Stillwater*.

Effect of acute nutritional deprivation on ovarian luteal function and plasma concentrations of glucose, insulin, IGF-I, NEFA, and thyroxine was determined in 14 mo old Angus x Hereford heifers (BCS=5.7; 317 $\pm$ 2 kg BW). Heifers (n=19) were housed in individual pens in a barn and fed a diet supplying 1.2 x maintenance (1.2 M) for 1 wk to allow adaptation. Heifers were then randomly allotted on d 0 to either a diet supplying .4 x maintenance (.4 M) or 1.2 M. Heifers were treated with PGF on d -10, 0, and 10. Blood plasma was collected via tail venipuncture on alternate days. Heifers with plasma progesterone less than .5 ng/mL on d 15 to 21 were classified as anovulatory. Heifers on .4 M (306 $\pm$ 2 kg) lost BW (P < .01) while 1.2 M heifers (321 $\pm$ 2 kg) maintained BW. Seventy percent of .4 M heifers did not ovulate on d 14 while all

1.2 M heifers had normal luteal function. Nutritional restriction for 14 d did not alter plasma glucose or insulin. Heifers on .4 M had less plasma thyroxine (32.3 $\pm$ 1.7 ng/mL) than 1.2 M heifers (40.9 $\pm$ 1.7 ng/mL; P < .01). A day x diet (P < .01) effect on plasma NEFA was due to 1.2 M heifers maintaining NEFA concentrations while .4 M heifers had increased concentrations. Nutritional restriction decreased concentrations of plasma IGF-I in .4 M heifers from 50.5 $\pm$ 2.3 ng/mL on d 0 to 28.5 $\pm$ 2.3 ng/mL on d 14; however, 1.2 M heifers maintained concentrations (54.9 $\pm$ 2.3 and 58.4 $\pm$ 2.3 ng/mL on d 0 and 14, respectively; day x diet; P < .01). Acute nutritional restriction induced anovulation in 70% of heifers within 14 d, and plasma concentrations of NEFA increased while IGF-I decreased.

Key Words: Beef heifer, IGF-I, NEFA

934 Effect of source of Romosinuano germplasm and preweaning creep grazing on postweaning growth and puberty in heifers. C. C. Chase, Jr.*[1], M. J. Williams[1], A. C. Hammond[2], and T. A. Olson[3], [1]*USDA, ARS, Brooksville, FL*, [2]*USDA, ARS, Albany, CA*, [3]*University of Florida, Gainesville*.

Postweaning growth and puberty were determined for Romosinuano heifers from germplasm collected in Costa Rica (CR; n = 17) and Venezuela (VE; n = 34) that 98 d prior to weaning were either allowed to creep graze rhizoma peanut (*Arachis glabrata*; RP; n = 26) or no creep (n = 25). Postweaning, heifers were initially managed as a single group, then as two groups during a 90 d breeding season, and thereafter as a single group until the end of the study. Heifers were maintained on mixed bahiagrass (*Paspalum notatum*) and RP pastures (and hay) and fed 4.5 kg/d concentrate. Growth measurements were collected at the start of the study and at 28-d intervals for 358 d. Beginning three wk before the start of the breeding season and at 7-d intervals thereafter, blood was collected and plasma progesterone determined by EIA to assess puberty. At the start of the study, heifers from CR were older (236 vs 208 d; P < .01), heavier (218$\pm$7.1 vs 183$\pm$5.0 kg; P < .001), and taller (113$\pm$1.2 vs 110$\pm$.8 cm; P < .05) than heifers from VE. At the end of the study, heifers from CR were heavier (432$\pm$9.1 vs 387$\pm$6.4; P < .001) and taller (132$\pm$1.1 vs 129$\pm$.8 cm; P < .05) than heifers from VE. During the study, however, neither gain in BW (214$\pm$5.9 vs 204$\pm$4.2 kg, for CR vs VE, respectively) nor gain in hip height (19.0$\pm$1.0 vs 19.5$\pm$.7 cm) were affected by source of germplasm. Preweaning treatment did not affect BW or hip height at the start or end of the postweaning study; but non creep calves gained more (P < .05) BW than creep calves during the postweaning study (216$\pm$.8 vs 202$\pm$.8 kg). Age at puberty was similar between heifers from CR (428$\pm$8.5 d) and VE (419$\pm$6.0 d) and between creep (419$\pm$3.3 d) and non creep (427$\pm$3.4 d) heifers. Hip height (P < .10) and BW (P < .05) at puberty were influenced by the interaction of germplasm source x preweaning treatment. This appeared due to taller hip heights and heavier BW observed at puberty for CR-non creep heifers than for any of the other source-treatment combinations. Data from this study suggest that CR and VE heifers have similar postweaning growth rates and ages at puberty and that preweaning creep may depress postweaning gain in heifers but did not affect age at puberty.

Key Words: Heifers, Tropics, Puberty

PRODUCTION AND MANAGEMENT

935 Effects of two winter feeding methods on growth, conception, and cost of developing beef replacement heifers. C. L. Gasser*, E. W. Hawkins, R. W. Silcox, and C. W. Wiltbank, *Brigham Young University, Provo, UT*.

Performance of beef replacement heifers is crucial to a cow-calf operation, but heifer development is a major cost. The objective of this study was to determine whether beef heifers could be developed using low-cost winter pasture without compromising growth and reproductive performance. Crossbred Angus heifers were wintered on pasture residue with supplemented grass hay (P; n=40) or in drylots fed grass hay (D; n=80) for 77 days. Heifer age on d 1 ranged from 7.5 to 9.5 mo. Initial BW for P and D was 268 kg and 266 kg, respectively. Beginning on d 78, all heifers were sorted by weight and fed the same ration to reach breeding weight at d 120. Heifers were weighed on d 1, 23, 44, 65, 79, 107, and 121. Body condition score was determined on d 1 and 44. Blood samples taken on d 121 were assayed for progesterone level. Heifers were synchronized for breeding using MGA in the feed (d 89 to 103) followed by a

single Lutalyse™ injection on d 121. Heifers detected in estrus between d 122 and 126 were artificially inseminated using the AM/PM rule. All heifers were exposed to a bull from d 141 to 210. Pregnancy was determined by ultrasound on d 167 and 210. The treatment groups did not differ in BW over the course of the study or in blood progesterone levels. The number of heifers that exhibited estrus and received AI did not differ between treatments (p=0.147). D heifers had a higher conception rate from AI (P=46%; D=73%; p=0.033). However, overall pregnancy rate on d 210 did not differ between treatments (P=86%; D=95%). The overall cost of development was higher for D than P. There is evidence that beef replacement heifers may be developed using low-cost winter pasture without a significant change in overall growth and conception rates. However, to better ensure earlier conception, heifers should be fed a higher quality ration or a better supplement with pasture to avoid weight loss during periods of harsh winter weather.

Key Words: Heifer Development, Conception, Management

936 Effects of feeding beef heifers whole cottonseed or safflower seed during gestation on cold tolerance in newborn calves. R.E. Dietz*, J.B. Hall,, and W.D. Whittier, *Virginia Tech, Blacksburg.*

The effects of source of fat in late gestation diets on serum glucose and thermogenic response during short-term cold stress were examined in fall-born neonatal beef calves. Pregnant fall-calving heifers (n = 15) were randomly assigned to three dietary treatments: Control (CON, n=5), Cottonseed (COT, n=5) or Safflower seed supplement (SAF, n=5). Hay-based isonitrogenous and isocaloric diets met NRC requirements while containing 2.0%, 5.0% and 5.0% fat for CON, SAF and COT diets, respectively. Diets were fed for 47.5 ñ 5.4 d before calving. Heifers were weighed weekly and at parturition. At parturition, colostrum samples were taken from the dam, calves weighed, and vigor scores recorded. Calves remained with their dams for 5 h to nurse. At 5.5 h of age, calves were fitted with an indwelling jugular catheter. At 6.5 h of age, calves were placed in a 5C cold room for 90 min. Shivering scores (1= no shivering, 2 = slight shivering 3 = muscle shivering, 4 = severe muscle shivering), rectal temperatures and blood samples were taken every 15 min. Colostrum samples were analyzed for fat, solids, protein, lactose and IgG concentrations. BW and BCS of heifers at calving, and birth weights and vigor scores of calves were unaffected by diet (P>.5). Mean fat, lactose and IgG concentrations in colostrum were not different (P>.3) among treatments. SAF tended to increase colostral solids (P= .1) and protein (P = .13) compared to COT or CON. During cold stress, mean calf body temperature was unaffected, but mean glucose levels tended (P = .12) to be greater and shivering scores were non-significantly increased in CON compared to SAF or COT calves. Glucose concentrations averaged 74.4, 51.9, and 60.0 ñ 7.3 mg/dL, whereas shivering score averaged 2.14, 1.69, and 1.68 ñ .24 in CON, SAF and COT calves, respectively. We conclude that calves from dams fed high fat diets containing safflower seeds or cottonseed respond similarly to cold stress, but these responses are not necessarily consistent with greater cold resistance.

Key Words: Newborn animals, Fats, Cold tolerance

937 Nutrient content of spent microbrewery grains and variation with pub and brew type. B.A. Altizio*, J.E. Wohlt, and P.A. Schoknecht, *Cook College, Rutgers University.*

Brewers' grains have long served as a feedstuff for many livestock species. Large, commercial breweries are the major producer and source of brewers' grains in the U.S. feed industry. Today the popularity and number of microbreweries are increasing. It is questionable whether spent grains produced by smaller brew pubs are comparable to commercial brewers' grains. Therefore a study was conducted to determine the content and variation in nutrients of spent brewers' grains from three local pubs. Over a period of a year, 142 batches of wet spent grains were sampled. Content of DM, and CP, NDF, ADF, hemicellulose, ash, Ca, P, Mg, K, Na (DM basis) averaged 24.8, 20.9, 46.1, 22.3, 23.8, 3.97, 0.22, 0.70, 0.26, 0.07, 0.02%; respectively in spent grains from brew pubs. In comparison, wet brewers' grains (NRC Dairy, 1989) contain 21.0, 25.4, 46.0, 24.0, 22.0, 4.8, 0.33, 0.55, 0.16, 0.09, 0.23%; respectively. Wet microbrewery grains tended to be drier, but contained less CP and ash (all minerals except P) than brewers' grains. Fiber fractions were high in both microbrewed and commercial brewers'grains. All three pubs produced a golden ale (n=10/pub). Spent wet grains from the golden ale brews did not differ in DM or CP content, but did differ in fiber (NDF, ADF, hemicellulose; p<0.01) and mineral (ash, Ca, Mg; p<0.05) content with pub. Brew type (golden ale, pale ale, India pale ale, specialty brews, n=10/brew), all brews produced at one pub, had no influence on nutrient content. Thus, spent grains from a single microbrewery or from multiple breweries are a uniform source of CP; but contain less CP than commercial brewers' grains, possibly due to less soluble carbohydrate extraction and additions of spent microorganisms.

Key Words: Wet microbrewery grains, Brew type, Nutrient content

938 Influence of simulated feedyard dust on performance of market stressed steer calves protected with or without prophylactic antibiotic. N. K. Chirase*[1,4], L. W. Greene[1,4], C. W. Purdy[2], B. W. Auvermann[1], R. W. Loan[3], D. B. Parker[4], and M. D. Hoover[5], [1]*Texas Agricultural Experiment Station, Amarillo,* [2]*USDA/ARS, Bushland, TX,* [3]*Texas A&M University, College Station,* [4]*West Texas A&M University, Canyon,* [5]*Lovelace Respiratory Research Inst., Albuquerqe, NM.*

Dust from confined animal feeding operations can become extensive during dry environmental conditions. However, there is very little data on the effects of this dust on animal performance. Two experiments (Exp 1 and 2) were conducted to determine the effects of dust on the performance of steers protected or not protected with antibiotic. The simulated dust storm was produced by enclosing cattle in a canvas tent. Calves (Exp 1:n=105, average BW 207 kg; Exp 2:n=120, average BW 210 kg) were purchased in Newport, TN and transported to Bushland, TX. One half of the calves received Micotil® (1 ml/30 kg of BW s.c.) in Newport (Exp 2) or at Bushland (Exp 1). Calves were allotted randomly into three dust treatment groups: 1) Control (not exposed to tent and dust), 2) Tent (exposed to tent only) and 3) Dust (exposed to dust suspension inside tent). There were four dust application events, each lasting 1 h (Exp 1; d 0 to 7) or 4 h (Exp 2; d 0 to 23). Calves were weighed approximately every 7 d and ending on d 28. All data were subjected to the analysis of variance using the General Linear Models procedure of SAS. In Exp 1, there was no interaction (P>.05) between Micotil® and dust treatment for ADG. The ADG of all dust treatment groups were not different (P>.05). However, ADG for Micotil® protected calves was greater (P<.02) than the control (1.18 vs 0.86 kg/d, respectively). In Exp 2, the feed intake for the control, tent and dust groups were 6.6, 6.6 and 5.5 kg/d, respectively. An interaction (P<.05) occurred between dust application and Micotil® for ADG. Calves protected with Micotil® and exposed to dust had greater (P<.02) ADG than those not protected (1.94 vs 1.26 kg/d). These data suggest that more research is required to determine the role of dust on cattle performance in the feedyard.

Key Words: Steers, Dust, Performance

939 Age and onset of puberty is negatively related to plasma testosterone in Nellore and Santa Gertrudis bulls. A.C. Sanches*[1], R.B. Lobo[2], and C.D.U. Magnabosco[3], [1]*Universidade Catolica de Goias,Goiania,GO/Brazil,* [2]*Universidade de Sao Paulo, Ribeirao Preto,SP/Brazil,* [3]*Embrapa Cerrados,Planaltina,DF/Brasil.*

In order to determine the relationship between the onset of puberty and plasma testosterone, 16 Nellore (N) and 23 Santa Gertrudis (SG) bulls were sampled at 15 day intervals, from 8 to 17 and from 5 to 15 months of age, respectively. Semen samples were obtained by electroejaculation, plasma was obtained by jugular venipuncture and stored at -20C. Plasma testosterone concentrations were measured using a commercial RIA kit (Diagnostic Products Co., Los Angeles, CA). Onset of puberty was determined by the appearance of adequate sperm counts (50 million with at least 10% motility). Bulls were classified into three groups, using a normal distribution and according to the age at puberty: early (E), medium (M), and late (L) sexual maturity. The average ages at puberty were 404.6 ± 47 and 424.9 ± 34 days for Nellore and Santa Gertrudis bulls, respectively. Early-maturing bulls reached puberty at similar ages in both breeds. Plasma testosterone concentrations varied between 2.76 and 10.44 ng/mL in N and between 0.09 and 8.31 ng/mL in SG. Overall, correlations between age at puberty and testosterone concentration were very low (P>0.05). In SG bulls, plasma testosterone concentrations were linearly related to age at puberty (P<0.01), however in N bulls there was no relationship. Early-maturing bulls of both breeds, had lower plasma testosterone concentrations than M and L bulls (4.51 ± 0.0, 5.60 ± 0.26, and 4.96 ± 0.42 ng/mL in N and 3.03 ± 0.74, 5.23 ± 0.60 and 5.12 ± 0.35 ng/mL in SG, respectively). These results suggest that the commonly held assumption that early-maturing animals have elevated testosterone in circulation may not always be true. The observation of lower testosterone in early-maturing bulls suggests that there may be lower production, or more rapid clearance of the hormone. Further work on the kinetics of plasma testosterone will be required to resolve this issue.

Key Words: Puberty, Testosterone, Beef cattle

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940 Assessment of the BCS system using real-time ultrasound to measure subcutaneous fat at the 12th rib, rump, and shoulder of beef cows at calving, breeding, and weaning. M. F. Browne* and D. E. Eversole, *Virginia Tech, Blacksburg.*

A study was conducted using real-time ultrasound to determine the correlation between body condition scores (BCS) of beef cows with subcutaneous (s.c.) fat thickness during three phases of production. Digitized scans of s.c. fat at three body sites were correlated to accurately predict BCS. Four hundred and twenty-five observations from 203 cows were analyzed. During calving (C), breeding (B), and weaning (W), all cows were weighed, measured at the hip, scanned at the 12th rib (RB), rump (RP), and shoulder (SH). Each cow was assigned a numerical BCS by five experienced observers using a scale from one to nine. Data for BCS were correlated ($P \leq .001$) among the five observers at a value of .89. Body condition scores were highly correlated ($P \leq .001$) with RB, RP, and SH s. c. fat measurements at values of .71, .68, and .68, respectively, for data pooled across all production phases. Hip height had no significant effect on s.c. fat but was significant ($P \leq .05$) when combined with cow weight to predict BCS. Cow weight was significant ($P \leq .001$) when combined with BCS in predicting s.c. fat. Mean s.c. fat measurements for condition scores five through eight were significant ($P \leq .001$) in predicting BCS. These data suggest s. c. fat measurements are highly correlated to BCS and therefore can be used to predict BCS in beef cows during all stages of production. Real-time ultrasound is a useful tool for measuring s. c. fat and therefore predicting BCS of beef cows.

Key Words: Body Condition Score, Ultrasound, Beef Cows

941 Effects of postpartum fat supplementation on reproduction in primiparous 2-year-old and mature cows. J. F. Bader*[1], E. E. D. Felton[1], M. S. Kerley[1], D. D. Simms[2], and D. J. Patterson[1], [1]*University of Missouri Columbia, Missouri,* [2]*Consolidated Nutrition Omaha, NE.*

The objectives of this experiment were to determine the effects of fat supplementation on reproductive rates in primiparous 2-year-old heifers and mature cows. Primiparous 2-year-old heifers and mature cows were assigned to one of three postpartum supplemental treatments. Treatment 1(FP#1) contained 20.9% EE and 22.2% CP. Treatment 2 was the control group (C) and received a cracked corn and corn gluten ration containing 3.0% EE and 19.0% CP. Treatment 3 (FP#2) contained 16.9% EE and 20.5% CP. All treatments were fed 1.8 kg·hd^{-1}·d^{-1}. Mature cows (n=213) grazed predominantly Tall Fescue pasture with 65 cows in the FP#1 treatment, 80 cows in the C treatment and 68 cows in the FP#2 treatment. Two-year-old cows (n=54) were managed in dry lots and received Johnson Grass hay and a corn silage diet with 18 cows in each of the three treatments. Body condition scores were taken at the start of feed treatment and prior to breeding to evaluate effects of supplementation on body condition. Mature cows received supplementation for 45 d and 2-year-olds received supplementation for 51 d prior to their synchronized periods. Heifers and cows received MGA (.5mg ·hd^{-1}·d^{-1}) for 14 d followed by an injection of PG (25 mg Lutalyse®) 19 d after MGA withdrawal. Cows were observed for estrus for 6 days beginning on the day PG was administered. Cows were inseminated 12 hrs. after observed estrus. Data were analyzed using the General Linear Models procedure of SAS. Percentage data were analyzed by Chi square analysis. Estrus response among 2-year-old cows was influenced ($P<.05$) by feed treatment with 94% of FP#1, 44% of C, and 78% of FP#2 responding. Final pregnancy data have not yet been obtained. Although no differences among treatments ($P>.05$) were observed for mature cows that exhibited estrus during the synchronized period, there was a difference ($P=.05$) in first service conception rate for those cows that exhibited estrus (76%-FP#1, 60%-C, 73%-FP#2). These data suggest that postpartum supplementation of fat products to primiparous 2-year-old and mature cows may improve estrous cyclicity and resulting response to estrus synchronization, and enhance conception rate at first service.

Key Words: Fat supplementation, Estrus response, First service conception

942 Additive effects of strategic deworming with fenbendazole, supplementation with bambermycins, and(or) use of TBA-estradiol implants during the grazing phase on grazing-finishing performance of yearling steers. I. Grazing performance. W. K. Rowland*[1], E. G. Johnson[1], and R. T. Brandt, Jr.[2], [1]*Johnson Research, Parma, ID,* [2]*Intervet, Inc., Millsboro, DE.*

Three hundred and twenty English cross-bred, short-yearling steers (265 kg) were used in a 2 x 2 x 2 factorially arranged experiment to evaluate the main effects and interactions of strategic deworming with Safe-Guard® (fenbendazole), Gainpro® (bambermycins) supplementation, and(or) implantation with Revalor-G® (40 mg trenbolone acetate, 8 mg estradiol) on grazing performance, and subsequent feedlot performance and carcass traits. Each of the eight treatment combinations were assigned to each of 5 blocks of contiguous pastures (8 head per pasture group, 40 pasture groups total). Steers grazed 114 d on pastures containing 70-80% native grasses and(or) fescue, and 20-30% legume species (alfalfa or clover). All steers received .91 kg/hd/d of a corn-based supplement. Strategically dewormed steers received a 10% Safe-Guard oral suspension on day 0, and Safe-Guard 1.96% Flaked Meal via the corn supplement on d 28 and 56. Treatment groups receiving Gainpro were fed 20 mg of bambermycins daily. All Safe-Guard treatments provided 5 mg/kg body weight of fenbendazole. There were no two- or three-way interactions ($P > .05$), demonstrating that performance enhancement from strategic deworming with Safe-Guard, supplementation with Gainpro, and implantation with Revalor-G were additive. Strategic deworming with Safe-Guard increased ($P < .0008$) weight gain by 10.0 kg compared to no deworming. Supplementation with Gainpro and implantation with Revalor-G provided an additional 9.1 kg ($P < .0017$) and 17.3 kg ($P < .0001$) of weight gain, respectively. Economic analyses showed that use of a Safe-Guard strategic deworming program, along with Gainpro and Revalor-G, resulted in a net profit that was $31.31 per head greater than for the negative control steers. A comprehensive pasture management system involving strategic deworming with fenbendazole, bambermycins supplementation, and implantation with Revalor-G provided additive effects to grazing performance and economic return to stocker steers.

Key Words: Fenbendazole, Bambermycins, Trenbolone acetate

943 Additive effects of strategic deworming with fenbendazole, supplementation with bambermycins, and(or) use of TBA-estradiol implants during the grazing phase on grazing-finishing performance of yearling steers. II. Finishing performance and carcass traits. W. K. Rowland*[1], E. G. Johnson[1], R. T. Brandt, Jr.[2], and W. T. Nichols[2], [1]*Johnson Research, Parma, ID,* [2]*Intervet, Inc., Millsboro, DE.*

A 140-d finishing trial was conducted to measure carryover effects of strategic deworming with Safe-Guard® (SG), supplementation with Gainpro® (GP), and(or) implantation with Revalor-G® (RG) during summer grazing on subsequent feedlot performance, carcass merit, and combined grazing-finishing gain. Pasture treatments were arranged in a 2 x 2 x 2 experiment. Results of the grazing phase of this trial are reported in the first abstract of this series. Pasture groups were gathered at the end of grazing, held overnight, and weighed. There were 40 pens of 8 head each (5 pen replicates per treatment combination) in this study. Feeding, management, and health practices were identical for all treatment groups during the feedlot phase. No two- or three way interactions ($P > .05$) between SG, GP, and RG occurred for feedlot performance or carcass traits in this study. Use of SG on pasture resulted in ($P < .05$) 10.0 kg heavier feedlot final weights, 6.4 kg more carcass weight, .47 units higher dressing percentage, 15 percentage units more Choice carcasses, and fewer dark cutters than non-SG steers. Steers supplemented with GP on pasture numerically maintained weight advantages through the finishing phase, with no effect on feedlot performance or carcass merit. Steers implanted with RG on pasture had ($P <.05$) 5.5% poorer feed conversion, but 15.0 kg heavier final weights and 9.1 kg more hot carcass weight than non-RG steers. Most of the reduction in feed efficiency with RG was explained by heavier initial feedlot weights, using net energy equations. Use of RG on pasture did not affect carcass quality. The effects of SG, GP, and RG on combined grazing-finishing gain were additive, and resulted in an additional 28.6 kg of gain. Economic analyses for the combined grazing-finishing period showed that using SG, GP, and RG together during the pasture phase increased net profit by $31.58 per head for steers sold on a formula basis, or $14.86 per head for steers sold live.

Key Words: Fenbendazole, Bambermycins, Trenbolone acetate

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944   Computer assisted semen analysis of bovine semen. H. L. Higdon III*[1], W. B. Boone[1], J. C. Spitzer[2], and W. C. Bridges, Jr.[2], [1]*Greenville Hospital System, Greenville, SC,* [2]*Clemson University, Clemson, SC.*

Computer assisted semen analyzers (CASA) are used routinely to objectively analyze spermatozoal integrity and ascertain reproductive potential among human subjects. Likewise, semen samples are obtained from yearling beef bulls as part of the standard breeding soundness evaluation (BSE). Our objective was to provide preliminary data generated by an automated semen analyzer [Hamilton-Thorne V10 Integrated Optical Visual System (IVOS), Beverly, MA] on semen collected from yearling beef bulls that were rated satisfactory potential breeders by the Society for Theriogenology 1993 BSE requirements. Data included IVOS spermatozoal parameters obtained at the 2000 Clemson University performance bull test from 49 beef bulls. In brief, three replications from each semen specimen were diluted in 1% BSA:PBS to between 20 to 50 million spermatozoa/mL, vortexed, and loaded into MicroCell^{TM} 20 micron chambers (Conception Technologies, San Diego, CA). A minimum of six fields and 200 spermatozoa were counted for each replication. Slow moving cells were not counted as motile. Mean and standard deviation for ejaculate volume, total spermatozoal concentration and percent motility were 5.3 ± 2.7 mL, 464.8 ± 500.9 million/mL, and $75.3\pm15.9\%$, respectively. Mean and standard deviation for IVOS spermatozoal kinematics were as follows: average path velocity (VAP) 123.6 ± 14.0 μm/s; straight line velocity (VSL) 104.8 ± 12.4 μm/s; point-to-point track velocity (VCL) 205.1 ± 28.9 μm/s; amplitude of lateral head displacement (ALH) 7.7 ± 1.5 μm; beat cross frequency (BCF) 35.0 ± 6.6 Hz; straightness (STR) $82.7\pm5.4\%$; linearity (LIN) $52.5\pm6.4\%$; elongation $41.6\pm3.8\%$; head area 13.0 ± 1.8 μm^2; rapid motile cells $61.1\pm16.9\%$; medium motile cells $14.2\pm5.8\%$; slow motile cells $10.1\pm5.4\%$; static cells $14.6\pm12.8\%$. This study provides preliminary information from which more objective means may be developed to assess reproductive potential among yearling beef bulls.

Key Words: Breeding Soundness Evaluation, Computer Assisted Semen Analysis, Beef Bulls

945   Pregnancy rates in postpartum beef cows after synchronization with GnRH, PGF$_{2\alpha}$, and MGA. M. L. Borger and W. A. Greene*, *The Ohio State University, Wooster.*

Eighty-eight beef cows were allotted to four similar groups based upon breed, age, postpartum interval, and postpartum cyclicity (as determined by ultrasonography) to compare pregnancy rates (PR) among four synchronization regimens. All four groups received GnRH i.m. on d 0, prostaglandin F$_{2\alpha}$ (PGF$_{2\alpha}$) i.m. on d 7, GnRH i.m. on d 9 (48 h after PGF$_{2\alpha}$), and were artificially inseminated 16 h after the d 9 GnRH injection. Groups 1 and 2 were fed melengesterol acetate (MGA) from d 0 to d 6 at a rate of .5 mg/cow/d while Groups 3 and 4 were fed only the base diet. Groups 1 and 3 received 50 μg of GnRH at each injection while Groups 2 and 4 received 100 μg of GnRH each time. Following the synchronization period, repeat breedings were done until d 54. Cows were pregnancy diagnosed by ultrasonography on d 33 and d 77. PR to synchronization (PR-SYNC) and overall PR were similar among all groups (P>.05). PR-SYNC for Groups 1, 2, 3, and 4 were 66.7, 54.6, 50, and 50%. Overall PR for Groups 1, 2, 3, and 4 were 85.7, 77.3, 86.4, and 77.3%. MGA tended to improve (P=.39) PR-SYNC (60.5 vs. 50.5%). PR-SYNC and overall PR were not affected (P>.05) by postpartum cyclicity status at time of synchronization. Beef cows receiving 50 μg of GnRH had similar PR to those receiving 100 μg of GnRH, regardless of the addition of MGA to the ration or postpartum cyclicity status.

946   The influence of vitamin E on immunoglobulins in the serum of cows and calves and colostrum of cows on 1, 2, 7, and 14 days after calving. A.L. Rivard*, T.A. Hoagland, K.E. Govoni, S.A. Zinn, and R.M. Hoffman, *University of Connecticut, Storrs.*

Twenty-five pregnant beef cows, eleven Angus and fourteen Hereford, were randomly allocated within breed to receive Vitamin E (3000 IU) or non-injected controls: injections were given two-month and one-month before parturition. The purpose of this study is to investigate the influence of Vitamin E on the concentration of IgG (IgG1 and IgG2), IgA, and IgM in the blood of cows and calves and in the dam's colostrum. Colostrum was sampled within ten minutes of parturition. Blood was

obtained on the day of calving (d1), the day after (d2), and then once a week for two weeks after calving. The concentration of IgG, IgG1, IgG2, IgA, and IgM was determined by single radial immunodiffusion (VMRD, Inc.). The concentration of IgG1 ($1733\tilde{n}55$ mg/dl) in the colostrum on d1 was greater (P<.001) than any of the other globulins measured. IgA ($814\tilde{n}22$ mg/dl) was elevated over (P=0.0008)the concentration of IgG2 ($346\tilde{n}8$ mg/dl) and IgM ($224\tilde{n}67$ mg/dl)in colostrum. Pre-parturition Vitamin E treatment did not influence the concentration of any globulins measured in the colostrum. The concentration of IgG ($2732\tilde{n}989$ mg/dl) was three to ten-fold greater (P<.0001) than the other globulins in cow serum with IgG1 being dominant over IgG2. IgG2 concentration was greater than IgM, which was in turn greater (P<.01) than IgA, which was the least. The concentration of globulins in cow serum varied over days sampled. In calf serum, IgG1 concentration rose from nondetectable to $3616\tilde{n}120$ mg/dl by d2. Although increases in calf serum IgA, IgM and IgG2 were observed, they were smaller than those of IgG1. Pre-partum Vitamin E did not influence (P=.6578) calf serum immunoglogulin concentrations. Averaged over all cows and calves, immunoglobulins were greater in cow than calf serum with significant differences (P<.0001) in IgM and IgG2. In conclusion, Vitamin E treatment during late gestation did not alter the remarkable uptake of immunoglobulins, predominantly IgG1, from cow colostrum by the neonatal calf.

Key Words: Calf, Colostrum, Immunology

947   Effects of horn fly (Diptera: Muscidae) control on growth and reproductive performance of Angus and Brangus heifers. W. E. Wyatt*[1] and L. D. Foil[2], [1]*Louisiana State University Agricultural Center, Jeanerette,* [2]*Baton Rouge.*

A total of 151 Angus (A) and Brangus (B) heifers (12 and 10 sires) were retained from the 1996 (Y1; 42 and 42) and 1997 (Y2; 32 and 35) calf crops as herd replacements. Prior to the initiation of the breeding season in mid-April, heifers within breed were randomly allotted to one of two treatment herds. In mid-May, a 30% diazinon -10% chlorpyrifos insecticidal ear tag (Warrior$^{®}$, Y-Tex Corporation, Cody, WY) was placed in each ear of heifers in one herd within each breed (T). Heifers in the remaining herds were not treated for horn fly control (NT) throughout the May to October season. Seasonal mean fly counts per side of cow were 52, 24, 47, and 18 in Y1 and 60, 20, 40, and 14 for Angus and Brangus NT and T herds and were below the presumed economic threshold of 200 flies per side. Heifers calved the following spring at 2 yr of age. Heifer weight and gain data and calving and calf performance data were analyzed as a randomized block design using a generalized linear mixed model procedure. Fixed effects included year, breed, and fly control treatment. Sire within breed was treated as a random effect. Treatment (NT vs T) affected weight at tagging (P<.10; 328 vs 337 kg) and fall weight (P<.05; 376 vs 384 kg). Daily gain from tagging to fall (G) was similar between treatments. Fall weight (389 vs 371 kg) and G (.33 vs .27 kg) were greater (P<.1) for B than for A. Tagging weight differences between A and B were greater in Y2 (326 vs 348 kg) than in Y1 (330 vs 326 kg) (P<.05). Calves born to A cows were born earlier (P<.01) in the year (44 vs 57 d) than those from B, but had lower (P<.01) preweaning ADG (PG; .67 vs .79 kg) and were lighter (P<.01) at weaning (188 vs 210 kg). Calves from NT cows had lower (P<.01) PG (.70 vs .77 kg) and lighter (P<.01) weaning weights (190 vs 208 kg) than calves from T cows. Treatment differences in heifer G and fall weight may be associated with unintentional differences in tagging weight. However, this explanation seems less plausible in terms of calf performance.

Key Words: Horn fly, Angus heifers, Brangus heifers

948   Effect of dietary energy on pubertal development and reproductive traits of Brangus and Simbrah bulls. C. R. Barthle, B. A. Reiling, J. V. Yelich, R. E. Larsen, and J. W. Lemaster, *Universtiy of Florida, Gainesville.*

Brangus (n=27) and Simbrah (n=20) bulls (325 d of age, 296 kg) were used in a switchback designed study to evaluate the effect of dietary energy on measures of pubertal development and reproduction in a 112 d feeding trial. Bulls were initially blocked according to breed, age, body weight (BW), sperm concentration, and scrotal circumference (SC) and randomly allotted to either a low (L; 55%) or high (H; 80%) concentrate diet. On d 57 of the experiment, half of the L- and H-energy treatment bulls were randomly reassigned to the opposite dietary treatment (LL, LH, HL, HH). Breeding soundness examinations were conducted

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every 28 d, and blood samples were taken at 14 d intervals to measure metabolic and reproductive hormone concentrations. The LL and HH dietary regimes produced the lightest and heaviest (P < .05) weight (455 vs 512 kg) bulls at the end of the trial, respectively. Over the entire trial ADG (P < .07) of LL, LH, HL and HH bulls were 1.43, 1.74, 1.73 and 1.89 kg/d, respectively. Puberty in bulls was defined as the age in which the ejaculate contained a total of 500 million sperm with a minimum progressive motility of 10%. No breed or treatment effects were detected for age or physiological parameters of puberty. Bulls reached puberty at an average age of 373 ± 7 d, BW of 391 ± 12 kg, and a SC of $30.74 \pm .66$ cm. Over time, SC (25.7 vs 34.5 cm), semen volume (3.6 vs 9.1 ml), total sperm (35.9 vs 1356.8×10^6), percentage of normal sperm (30.7 vs 68.4%), and gross (30.5 vs 49.9%) and progressive (22.8 vs 38.2%) sperm motility increased (P < .05) while the percentage of proximal droplet abnormalities decreased (P < .01; 30.5 vs 9.5%). In conclusion, dietary energy did not affect any of the reproductive parameters measured.

Key Words: Bulls, Reproduction, Energy

949 The effect of Angus sires selected for growth or maternal traits: Preweaning and yearling reproduction traits. J. B. Barber*, H. D. Ritchie, D. R. Hawkins, B. D. Banks, S. R. Rust, and D. Neilsen, *Michigan State University, East, Lansing, MI.*

Angus sires selected for either growth (GS) or maternal (MS) traits were mated to commercial cows to investigate preweaning and reproduction traits. Seventeen GS sires were selected on yearling weight expected progeny differences (EPD) from the National Cattle Evaluation program, with a mean percentile of 99 and a minimum accuracy of .60 in the year in which they were selected. Twenty MS sires were selected on milk and birth weight EPD, with mean percentiles above 98 and 80, respectively, and minimum accuracy of .60 for each trait. Data were pooled across 5 yr and analyzed within sex for steers and heifers. Steer calves (n=348) sired by GS had heavier (P<.05) birth weights (43.8 vs. 40.2 kg), heavier (P<.05) adjusted 205-d weights(331 vs. 293 kg), and larger (P<.05) weaning frame scores (5.8 vs. 5.4), on a 1 to 9 scale) than steers sired by MS. There was no difference in calving ease score as a trait of the calf. Heifer calves (n=324) sired by GS had heavier (P<.05) birth weights (41.2 vs. 37.9 kg), heavier adjusted 205-d weights (274 vs. 266 kg), and larger (P<.05) weaning frame scores (6.0 vs. 5.7) than those sired by MS. Yearling heifers retained (n=280) were evaluated for reproductive traits prior to their first breeding season. Females sired by GS had heavier (P<.05) adjusted yearling weights (381 vs. 369), were larger (P<.05) framed (6.0 vs. 5.7) and had larger adjusted pelvic areas (202 vs. 194 cm^2) than those sired by MS. There were no differences between GS- and MS-sired heifers in yearling condition score, or reproductive tract score. Steers sired by bulls selected for growth had heavier birth and weaning weights and larger frame scores than those sired by bulls selected for maternal traits. Heifers sired by growth bulls had heavier birth, weaning, and yearling weights, larger frame scores, and pelvic areas than heifers sired by maternal bulls, with no differences in condition or reproductive tract scores.

Key Words: Beef cattle, Reproduction, Maternal

950 The effect of Angus sires selected for growth or maternal traits: Feedlot performance and beef characteristics. J. B. Barber*, H. D. Ritchie, D. R. Hawkins, B. D. Banks, S. R. Rust, and D. Neilsen, *Michigan State University, East Lansing.*

Three-hundred-forty-eight Angus-sired crossbred steers were used to evaluate feedlot performance and carcass characteristics of calves by growth or maternal sires (GS or MS). Growth sires were selected on yearling weight expected progeny differences (EPD) from the National Cattle Evaluation program, with a mean percentile of 99 and a minimum accuracy of .60 in the year in which they were selected. Maternal sires were selected on milk and birth weight EPD, with mean percentiles above 98 and 80, respectively, and minimum accuracy of .60 for each trait. Data were pooled across 5 yr and analyzed, after weaning, steers were finished in confinement and allocated to pens by weight and group. Intial weight was greater (P<.05) for GS calves than MS calves (277 vs. 268 kg). Steers were slaughtered and carcass characteristics were measured 24 h post-slaughter. Final weight and hot carcass weight was heavier (P<.05) for GS than MS steers (555 vs. 535 kg) and (334 vs. 321 kg), respectively. Steers sired by GS also had greater (P<.05) frame scores(6.0 vs. 5.5), larger (P<.05) rib eye area(1.91 vs. 1.84 cm^2), and higher (P<.05) marbling score(5.8 vs. 5.6). No differences were found between sire groups for external fat; kidney, pelvic, and heart fat; or yield grade. Selection for growth versus maternal traits, using sire EPD, increased hot carcass weight, rib eye area, and marbling score.

Key Words: Beef cattle, Carcass, Growth

951 Growing and finishing performance of calf-fed, short- and long-yearling steers. R. D. Sainz*, D. J. Kominek, and M. Sween, *University of California, Davis.*

Sixty Angus-Hereford steers were allocated at weaning (May 1997) to three groups. Calf-fed (CF) steers were sent to the UCD feedlot immediately, short-yearlings (SY) remained on irrigated pasture until Sept. 1997, then sent to the feedlot, and long yearlings (LY) remained on irrigated pasture until Sept. 1997, then on native range until May 1998, then sent to the feedlot. All steers were fed on a high-energy corn-based ration until average ultrasound backfat for the group reached 12.7 mm. Days on feed were 192, 114 and 83 for CF, SY and LY, respectively. During the first summer grazing period, SY and LY gained 0.699 and 0.700 kg/d (SD 0.099), respectively. LY lost 0.055 ± 0.136 kg/d during the subsequent fall and winter, then gained 1.107 ± 0.158 kg/d during the spring. In the feedlot, SY gained more rapidly than CF and LY, which were similar (1.424, 1.122 and 1.219 kg/d, respectively; P<0.001). Pen average DM intakes in the feedlot were 7.97, 9.00 and 12.34 kg/d for CF, SY and LY, respectively. This resulted in gain:feed (DM basis) and feed costs of gain ($/kg) of 0.140 and 0.80, 0.158 and 0.55, and 0.099 and 1.41, respectively. Short yearlings were more efficient than calf-fed steers, and had much lower costs of production. In this study, long yearlings were very inefficient in the feedlot, contrary to expectations. The reasons for this are unclear, but may include their very rapid previous gains on spring pasture, and also the fact that they entered the feedlot at 435 kg and thus were in a fattening phase.

Key Words: Grazing, Finishing, Beef cattle

952 Relationship between carcass and reproductive traits in Angus heifers. J.A. Minick*[1], D.E. Wilson[1], G.H. Rouse[1], A. Hassen[1], M. Pence[2], and R. Sealock[1], [1]*Iowa State University, Ames,* [2]*University of Georgia, Athens.*

Carcass and reproductive data including scan weight (WT), ribeye area (REA), rump fat (RUMP), 12-13th rib fat (RIB), and percentage intramuscular fat (PFAT) at 268, 303, 370 and 405-d; reproductive tract score (RTS) at 344-d; pregnancy status (PREG) after the breeding season; and number of services to conception of AI bred heifers were collected on 180 1998-born Angus heifers to determine the relationship between these traits. RTS ranged from one, a non-cycling tract, to five, a cycling tract as indicated by a corpus luteum. For further analysis, a cycling (CY) score was assigned based on the RTS (4, 5 vs. 1-3). Data were analyzed by the general linear model of SAS. Within animal regressions using linear and quadratic effects of age were fitted to each of the carcass traits. These were used to adjust the carcass data back to the age at which each heifer was evaluated for RTS, and to a 395-d endpoint, which is the average age for carcass ultrasound scanning of Angus heifers in the industry. All carcass measurements at each scan and adjusted age were compared to RTS, PREG and CY. Chi-square tests were performed between the categorical variables of RTS, PREG, CY and number of services to conception. There was no relationship between RTS and any of the measurements of RIB, REA or PFAT (P > .10). Heifers with higher RTS tended to be heavier at 405-d and to have more rump fat at 405-d. Heavier heifers and heifers with more rump fat had higher RTS when they were adjusted to 395-d by both models (P < .05). There was no relationship between PREG and any of the carcass variables analyzed (P > .10). There was no relationship between CY and any measures of RUMP, RIB or PFAT. Heifers that were cycling tended to be heavier at 405-d and have larger REA at 370 and 405-d, and at 395-d adjusted by both models (P < .10). Chi-square tests showed there was no relationship between RTS, PREG and number of services (P > .10). Heavier heifers that are farther along in their growth and development, as evidenced by increased amounts of rump fat, are more likely to have higher RTS at approximately one year of age.

Key Words: Beef, Reproduction, Carcass

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953   Body weight changes in stocker cattle during the initial grazing period on winter wheat pastures. W. A. Phillips*[1], S. W. Coleman[2], and M.A. Brown[1], [1]USDA-ARS El Reno, OK, [2]USDA-ARS Brooksville, FL.

Each year millions of stocker calves are used to graze winter wheat pasture in the Southern Great Plains. Wheat forage is a novel diet to which these stockers are not accustomed. The objective of this experiment was to determine body weight changes that occur in stockers calves as they adjust to winter wheat pasture. Forty crossbred spring born calves (mean BW=262kg)reared at the Grazinglands Research Laboratory were blocked by sex, breed and BW after weaning in the fall. Within each block calves were randomly assigned to one of four treatment groups. All four groups were limit fed a mixed diet with ad libitum access to grass hay for a 14-day training period. Nutrient density and quantity of diet fed was designed to promote an ADG of 0.8 kg. During the training period calves in Groups 1 and 2 (INTENSIVE) were weighed every 2 to 3 d, while the calves in Groups 3 and 4 (EXTENSIVE) were only weighed at the beginning and end of the period. At the end of the training period (day 14), the calves in Groups 1 and 3 were moved to winter wheat pastures. The remaining calves were left in dry lot without a change in diet. From day 14 through day 42, calves in the INTENSIVE groups were weighed 11 times while the calves in the EXTENSIVE groups were weighed only twice (d 29 and 42). During the training period, calves weighed more frequently (INTENSIVE) had lower (P=.03) ADG than calves weighed less frequently (0.87 vs 1.24 kg). Weighing frequency had no effect (P>.10) on weight gain during the 28-d grazing period, but calves placed on wheat pasture lost 6.9 kg of BW during the first 15 d of grazing as compared to a positive gain of 16.2 kg by calves that remained in dry lot. During the second half of the grazing season, calves on wheat gained 20.8 kg, while the calves in dry lot gained 13.2 kg. However, over the entire 28-d grazing period, calves on wheat had a lower (p<.05) ADG than the calves in dry lot (0.49 vs 1.03). From these data we conclude that calves placed on wheat pasture for the first time need 14 to 21 d to adapt to the new diet and begin to make positive weight gains.

Key Words: Wheat pasture, Steers, Stocker

954   Simulated effects of heifer replacement strategies on production and income from beef cattle production in Virginia. J. H. Schick*[1] and W. D. Hohenboken[2], [1]Case Western Reserve University, [2]Virginia Tech, Blacksburg.

The objective of this study was to utilize the Virginia Beef Cattle Simulation Model, a management decision aid developed for the mid-Atlantic region, to predict financial and production impacts of different heifer replacement strategies on a cow/calf operation retaining weaned calves in an 80-d forage-based stocker program. The base herd, located in the mountain region of Virginia, had 115 crossbred Angus females. Replacement strategies included: 1) selecting heifers from within the herd, 2) purchasing heifers to grow out and breed, and 3) purchasing bred heifers to replace nonpregnant cows 60 d after the end of the breeding season combined with either A) purchasing nonpregnant heifers or B) selecting them from within the herd at all other times to maintain herd size. Spring and fall calving seasons were simulated. Each of the eight possible management combinations was simulated 10 times with data captured for 3 yr. Systems that replaced culled cows with nonpregnant heifers purchased at market value or selected from within the herd were financially superior to systems that bought pregnant replacements (P < .01). Under each replacement strategy, retaining calves in a forage-based stocker program enhanced profits (P < .01) compared to the same systems but with calves sold at weaning. When calves were retained in a stocker program, total net income from spring vs. fall calving systems was similar (P > .05). Although higher prices received for fall-born calves sold in the spring than for spring-born calves sold in the fall magnified replacement policy effects, purchasing bred heifers was not predicted to be a profitable strategy for either calving season. Because of the small financial differences predicted between selection and purchase of replacement heifers, producers could use the strategy that most conveniently provided them with the genetic type of heifer most suitable to profitable and sustainable production.

Key Words: Replacement Heifers, Beef Cattle, Simulation

955   Effect of a stair-stepped growth regimen during gestation on performance of beef heifers - prepartum growth performance. W.W. Poland*[1], K.A. Ringwall[1], M. Encinias[2], L.J. Tisor[1], G. Ottmar[1], J.W. Schroeder[2], and C.S. Park[2], [1]North Dakota State University, Dickinson, [2]North Dakota State University, Fargo.

A stair-step nutrition and feeding regimen has been shown to produce compensatory responses in growth efficiency and increase subsequent lactation performance. Objectives of this study were to determine the effect on growth performance and lactation potential of beef heifers reared on a simplified stair-step growth regimen imposed during gestation. Lactation performance is reported in a companion abstract. Twenty pregnant beef heifers (463±37 kg; 6.7±.3 body condition score [BCS]) were blocked by breeding sire and assigned to either a constant (C) or a stair-step (S) growth regimen for 18 wk immediately prepartum. Animals assigned to C were fed a diet designed to meet the nutrient requirements of heifers gaining .45 kg/d throughout the feeding period, while S heifers were fed an energy-restricted diet for 9 wk. Metabolizable energy concentration (ME) of the restricted diet was similar to C, however dry matter intake (DMI) was to be limited to 70% of C. Protein concentration (CP) was increased in the restricted diet to allow similar daily protein intakes between treatments. Following the restriction phase, S heifers were given ad libitum access to a high energy (130% ME and 100% CP of C) diet to allow compensatory growth for 9 wk. Subsequently, all heifers were managed similarly through weaning. Average daily gain (ADG; .51 vs .17 kg/d for C and S, respectively; P<.10), BCS (6.5 vs 6.0, P<.15) and dry matter intake (DMI; 10.8 vs 8.2 kg/d, P<.01), but not growth efficiency (GE, gain/feed;.047 vs .021, P=.18), were reduced in the restricted phase of S. Conversely, ADG (-.14 vs 1.36 kg/d, P<.01), DMI (8.0 vs 8.8 kg/d; P<.05), BCS (6.2 vs 7.0, P<.06) and GE (-.017 vs .153; P<.01) were increased in the compensating phase of S. Over the entire feeding period, ADG (.20 vs .73 kg/d; P<.01) and GE (.022 vs .086; P<.01) were increased, whereas DMI (9.3 vs 8.4 kg/d; P<.05) was reduced, by the experimental regimen. These results indicate that beef heifers reared on a stair-step growth regimen during gestation display compensatory responses in average daily gain and growth efficiency.

Key Words: Stair-step, Beef Heifer, Gestation

956   Effect of a stair-stepped growth regimen during gestation on performance of beef heifers - postpartum lactation and calf performance. W.W. Poland*[1], K.A. Ringwall[1], M. Encinias[2], L.J. Tisor[1], G. Ottmar[1], J.W. Schroeder[2], and C.S. Park[2], [1]North Dakota State University, Dickinson, [2]North Dakota State University, Fargo.

A stair-step growth regimen during hormone-sensitive growth phases prior to first parturition can affect mammary development and subsequent performance. Objective of this study were to determine the effect on growth performance and lactation potential of beef heifers reared on a simplified stair-step growth regimen imposed during gestation. Prepartum growth performance is reported in a companion abstract. Twenty gestating beef heifers were blocked by breeding sire and assigned to either a constant (C) or a stair-step (S; managed for a slow followed by a rapid growth rate) growth regimen for 18 wk immediately prepartum. Following the experimental phase, all heifers were managed similarly. Immediately prior to calving, C heifers had lower BW (492.4 vs 546.1 kg for C and S, repsectively; P<.01) and body condition scores (BCS; 6.2 vs 7.0, P=.06) than S heifers. Calves from S heifers were born approximately 5 d earlier (P=.01), however birth weights (37.5 vs 36.7 kg; P=.61) did not differ. Three calves died at calving (1 C and 2 S), one (S) at 2 d of age and one (S) at 110 d of age. Neither milk production at 40 d postpartum (6.7 vs 6.3 kg/d; P=.72) nor milk composition (P>.33) in heifers with calves were affected by gestational treatment. Heifers and calves were moved to spring pastures at approximately 79 d postpartum. Heifers with calves had similar BW (458.8 vs 486.5 kg; P=.14) and BCS (6.0 vs 6.2; P=.32) at pasture turnout. Calves from S heifers (76.8 vs 84.7 kg; P<.05) were heavier, however average daily gains from birth to pasture turnout (1.00 vs 1.04 kg/d; P=.41) were not different. Calves were weaned at 234 d of age. Body weight (503.8 vs 536.9 kg; P=.11) and BCS (5.7 vs 5.9; P=.61) of heifers with calves were not different at weaning. At weaning, actual calf weight (264.3 vs 268.8 kg; P=.66), average daily gain (.98 vs .98 kg/d; P=.98) or weight per day of age (1.14 vs 1.13 kg/d; P=.93) were also not different due to gestational treatment. These data would suggest that a stair-step growth regimen

during gestation resulted in earlier calving dates, but did not affect calf birth weight, milk production or subsequent calf growth in beef heifers.

Key Words: Stair-step, Beef Heifer, Lactation

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957   Feeding supplemental fat to mature cows. R. A. Bellows*[1], E. E. Grings[1], D. A. Phelps[1], S. E. Bellows[1], T. W. Geary[1], and D. D. Simms[2], [1]*USDA-ARS and Montana Agric. Exp. Sta., Miles City, MT,* [2]*Consolidated Nutrition, Omaha, NE.*

Multiparous, crossbred cows (n = 140; ages 3-8 yr) grazing winter range forage and calving in Feb or April received one of three supplements during late gestation: 1, C, Control 1.4 kg pelleted alfalfa daily; 2, T, self-fed fat supplement in 102 kg plastic tubs; 3, B, fat supplement fed every-other-day in 15 kg compressed blocks. Supplement compositions (DM basis) were: C, 22.0% protein (P), 1.5% fat (F); T, 21.9% P, 25.9% F; B, 22.4% P, 14.2% F; fat was from safflower seeds. All cows received 10 kg hay (20% P, 1.5% F) daily during severe weather. Cow weights and condition scores were obtained during the study; estrous cyclicity at begin breeding was determined by P4 in blood; breeding was synchronized with injected PG given 5 d after begin breeding; pregnancy was based on ultrasound. Calf data included: birth weight, calving ease (CE), sex, and weaning weight. Data were analyzed by SAS-GLM and Chi square. Supplement feeding averaged 77.5 ± 7.1 d prepartum. Effects of delivery system and fat on dam precalving weights or condition scores and calf birth weight or CE scores were nonsignificant. Supplement consumption in B cows was uniform, but consumption by T cows varied from 0 to 4.5 kg (estimated) daily. T cows had higher post calving (P=0.09) and prebreeding (P<0.05) condition scores than C or B cows. C cows had higher (P=0.06) prebreeding P4 concentrations (1.5, 1.2, and 0.8 ng/mL, C, T, and B, resp.), but estrous cyclicity was not affected by fat or season. Cyclicity at begin breeding (P=0.08) and final pregnancy % (P=0.06) were affected by the calving season x delivery group interaction which suggested cows calving in Feb followed by limited forage postpartum benefitted from fat supplement, but cows calving in April did not. Fat supplement increased calf weaning weight 4 kg (P>0.20). We conclude effects of feeding fat during gestation are modified by forage availability postpartum and response in multiparous cows may differ from that in primiparous heifers.

Key Words: Cattle, Fat Supplement, Prepartum

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958   Improving the quality and value of market cows and bulls. D.L. Roeber*, K.E. Belk, J.D. Tatum, T.G. Field, J.A. Scanga, and G.C. Smith, *Colorado State University, Fort Collins.*

The 1999 National Market Cow and Bull Quality Audit was comprised of face-to-face interviews with industry representatives (n = 49), inplant evaluations of cattle/carcasses in holding pens (n = 3,969), on harvest floors (n = 5,679) and in carcass coolers (n = 4,378), and a Strategy Workshop. Face-to-face interview concerns related to price discovery for carcasses following excessive trimming due to bruises and arthritic joints, along with too frequent incidence of antibiotic residues and birdshot. In-plant audits revealed that 88.9%, 10.3% and 88.2% of cow carcasses and 18.9%, 21.2% and 52.9% of bull carcasses had inadequate muscling, arthritic joints and at least one bruise, respectively; all of which resulted in greater (P < .05) losses than the same defects in a similar audit in 1994. Also, 14.5% and 30.8% of cow carcasses and 6.9% and 5.9% of bull carcasses had excess external fat and yellow-colored external fat, respectively; which was an improvement (P < .05) to 1994 results. In aggregate, 24.1%, 19.2%, 7.2%, 6.7%, 9.5% and 1.1% of livers, tripe, hearts, heads, tongues and whole cattle/carcasses, respectively, were condemned and 60.6%, 2.4% and 46.5% of cattle had hide damage from latent defects, insect damage and brands, respectively. Condemnation rates were generally lower (P < .05), but tongue condemnations and branded hides were higher (P < .05) than in 1994. The four tactics to reduce the incidence of defects that emerged in the Strategy Workshop included recognize and maximize the value of your market cows/bulls, be proactive to ensure the safety and integrity of your product, use appropriate management and handling practices to prevent quality defects, and closely monitor herd health and market cull cattle at the appropriate time to avoid severe quality defects. A "Quality Assurance Marketing Code of Ethics" to facilitate implementation of these tactics was proposed. Producers should promote value in cows/bulls by managing to minimize quality defects, monitoring the health and condition and marketing in a timely manner. Using these techniques, producers might have recaptured $13.82, $27.50 and $27.50, respectively, for each cow/bull harvested in 1999.

Key Words: Quality, Cows, Bulls

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959   Comparing economic return to a group of co-operating beef producers for selling calves near weaning versus retaining ownership for a post-weaning growing period. R. L. Larson*, V. L. Pierce, and K. C. Olson, *University of Missouri, Columbia.*

Two groups of producers in Missouri commingled their calves after weaning for a post-weaning growing period. A group in Monroe City commingled spring-born calves on December 1 and marketed the calves in late January. A group in West Plains commingled fall-born calves on June 7 and marketed the calves in late August. Predicted return to management of the cowherd at the time of commingling shortly after weaning was estimated by using the weekly average calf prices from local livestock markets as reported by the Missouri Department of Agriculture. The return to management of the cowherd at the time of sale was determined by subtracting the expenses of the growing period from the gross receipts. The return at the time of sale was positively correlated most strongly with body weight at the time of sale for both the Monroe City cattle (r^2=0.963; P<0.0001) and the West Plains cattle (r^2=0.701; P<0.0001). Return at sale was also strongly positively correlated with body weight at arrival for both the Monroe City cattle (r^2=0.795; P<0.0001) and for the West Plains cattle (r^2=0.688; P<0.0001). Return at sale was moderately positively correlated with ADG for the Monroe City cattle (r^2=0.515; P<0.0001) and slightly positively correlated with ADG for the West Plains cattle (r^2=0.261; P<0.001). ADG was not correlated with arrival body weight in either group (P>0.1). T-test comparisons of cattle that had a greater return after being grown post-weaning versus those that had a greater return if sold shortly after weaning showed that ADG post-weaning was greater in cattle that benefited economically from the growing period than those that did not benefit (P<0.001). Body weight at sale was higher for cattle that benefited from the growing period (P<0.01). Body weight at the start of the post-weaning growing phase tended to be higher for cattle that did not benefit economically from the growing period versus those that benefited (P<0.1) for the West Plains calves, but was not different for the Monroe City calves.

Key Words: Post-weaning growth, ADG

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960   Evaluation of a simulated fenceless livestock control system. S. B. Markus*[1], D. W. Bailey[2], and M. Price[3], [1]*Alberta Agriculture Food and Rural Development,* [2]*Montana State University, Bozeman,* [3]*University of Alberta, Edmonton.*

New technology may allow development of fenceless livestock control systems (FLCS). Previous work suggests cattle movements can be controlled without physical barriers in both drylot and pasture situations. A trial was conducted using a simulated FLCS consisting of Tri-tronics® training units capable of emitting electric shock (5600 V) to the muzzle of an animal by remote control under a rotational grazing scenario. The objective of this study was to determine if visual and auditory cues increased the ability of cattle to identify and respond to a FLCS boundary. Thirty two yearling beef heifers were randomly allocated to 4 treatments in a randomized block design: control (FLCS with no additional cues), audio (FLCS with tone 1.5 m from boundary), visual (FLCS with ground flags 5 m apart along boundary), and audio and visual (FLCS with both tone and flags). In all treatments, cattle received mild shocks as they crossed the boundary and remained in the exclusion zone of a 0.5 ha pasture. Attempts to enter the exclusion zone and the number of shocks received during a 1 h observation period were similar (P>0.05) for all treatments. However, behavior varied (P<0.01) among days for all variables. On day 1, 34/% of the animals entered the exclusion area, while on days 2 and 3 less than 1/% entered. Cattle were first exposed to FLCS in a 20 x 30 m pen for 2 d before the study, however these results suggest training should occur under pasture conditions. Addition of visual and or audio cues did not affect the ability of cattle to detect and avoid the exclusion zone. Cattle appeared to associate the FLCS boundary with a patch rather than a widespread area or linear boundary. Social interactions were evident, as heifers appeared to follow lead animals. Cattle movements can be controlled without visual barriers using FLCS, provided they are properly trained.

Key Words: Cattle, Behavior

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961   Evaluation of a simulated livestock control system under equipment failure. S.B. Markus*[1], D.W. Bailey[2], and M Price[3], [1]*Alberta Agriculture Food and Rural Development,* [2]*Montana State University, Bozeman,* [3]*University of Alberta, Edmonton.*

New technology may allow for the development of livestock fencing systems without physical barriers. Previous work suggests cattle movements can be controlled with fenceless livestock control systems (FLCS) if properly trained. Social interacions among herd mates have been observed. Thus, a study was conducted to determine the influence of dominant animals on herd movements under a simulated equipment failure. A trial was conducted using a simulated FLCS consisting of Tritronics® training units capable of emitting electric shock (5600 V) to the muzzle of an animal by remote control under a rotational grazing scenario. Twelve beef heifers were randomly allocated to 3 treatments in a randomized block design: control (all 4 animals had functional FLCS units), one-off (1 of 4 animals had a non-functional FLCS unit), and two-off (2 of 4 animals had non-functional FLCS units). Animals with non-functional FLCS units were the most dominant in their treatment group based on social dominance ratings conducted before the study. Cattle were observed grazing in half of a 0.5 ha pasture for 1 h on 3 consecutive days. Heifers with functional FLCS units in each treatment did not differ (P>0.05) in the number of attempts to enter the exclusion zone or in the number of shocks received. Although social interactions were evident (heifers followed lead animals), adverse stimuli (mild shock) from the FLCS units had more influence on cattle behavior than being separated from dominant animals. Cattle with functional FLCS units were frequently observed to graze near the lead animals. Cattle movements can be controlled without visual barriers using FLCS. If equipment fails on a few individual animals, control of the herd can be maintained.

Key Words: Cattle, Behavior

962   The next dairy: A case study on factors to consider when establishing a new dairy at a remote site. N.R. St-Pierre*[1], L.R. Jones[2], and J.A. Pennington[3], [1]*The Ohio State University, Columbus,* [2]*FARME Institute, Homer, NY,* [3]*University of Arkansas, Little Rock.*

Changes in the marketing and milk pricing policies of US milk are encouraging producers to view the US milk production on a more global basis than what has been traditional. Many producers are actively looking at potential sites for building a new dairy in States that are far removed from their State of residence. This case study, based on the experience of a young New York producer along with his investment partners, provides a detailed description and analysis of the many factors involved in the site selection and the decision to build a new dairy: (1) societal and environmental considerations, (2) facilities and farmstead layout, (3) agronomic and natural resources considerations, and (4) production and financial risks. Participants are then asked to make a recommendation to the producer.

Key Words: Case Study, Site Selection, Dairy Relocation

963   Reproductive trends among Southeastern dairy herds. S.P. Washburn*[1], C.H. Brown[1], B.T. McDaniel[1], and S.L. White[1], [1]*North Carolina State University, Raleigh.*

Dairy records were examined to determine trends in the Southeastern region (VA, NC, SC, GA, FL, KY, AL, and MS) from 1974 to 1999. Year-end DHI herd summary data were from Dairy Records Management Services in Raleigh, N.C. Herds with data for at least 25 of 26 years were used. Herds with services per conception <1.4 were deleted due to the likelihood of unrecorded natural matings. Data were further processed by computing 4-year averages for the first (1974-1977) and last (1996-1999) periods and 3-year averages for other intervals. For statistical analyses, 2 Ayrshire, 1 Brown Swiss, and 2 Guernsey herds were grouped. Separate groups included 316 Holstein or 17 Jersey herds. Days open and services per conception averages by breed group and time period are shown below. Increases in herd size, milk, fat, days open, and services per conception across time were evident. Regression analyses indicated positive linear and quadratic effects of time on increasing days open (all groups) and positive linear and quadratic effects of time on increasing services per conception for Holsteins (only quadratic for

Jerseys). Services per conception tended higher with higher milk production in all breed groups but days open were lower in higher producing Holstein herds. Effects of herd size were small. Beginning in the late 1980's to early 1990's, services per conception and days open increased at a greater rate than in earlier years and such trends are of concern.

	Holsteins		Jerseys		Ayr.,	Swiss,Guern.
Time Period	Days Open	Services per Conc	Days Open	Services per Conc	Days Open	Services per Conc
1974-1977	127	1.85	127	1.81	126	1.97
1978-1980	127	1.98	127	1.90	129	2.12
1981-1983	128	2.07	123	2.00	127	2.33
1984-1986	129	2.10	119	1.94	133	2.18
1987-1989	134	2.22	122	2.24	130	2.24
1990-1992	139	2.59	126	2.53	140	2.63
1993-1995	147	2.96	136	2.96	143	3.04
1996-1999	162	3.12	147	3.08	173	3.08

Key Words: Dairy, Reproduction, Fertility

964   Monitoring estrus detection efficiency in dairy cattle using cusum and Shewhart charts. A. de Vries*, G. R. Steuernagel, and B. J. Conlin, *University of Minnesota, St. Paul.*

Objective of the study was to compare days to signal using binomial cumulative sum (cusum) and Shewhart (Xbar and I) charts of first service interval (days between calving and first service) and service index (number of services / number of eligible cow days) for a persistent decline in estrus detection efficiency. Cusum, Xbar and I charts are statistical process control charts which are used to monitor, control, evaluate, and analyse a process. Their design and applicability in dairy herd management has not yet been fully explored. Design of these charts depends on an acceptable type I / type II error ratio and the probability density function of the variable of interest. Weekly first service interval (FS) was charted with an Xbar chart and a cusum chart. Service index (SI) was charted with an I chart and a cusum chart. All charts were designed for a type I error rate of 1 in 360 days. A stochastic dynamic dairy herd simulation model was developed which simulates individual cows from day to day. A steady-state herd of 100 dairy cows was created. Default probability (Pr) of estrus detection was 0.45. Three scenarios were simulated for 200 runs of 3000 days each: A: no change in Pr(estrus detection), B: Pr(estrus detection) = 0.35 after day 500, and C: Pr(estrus detection) = 0.35 during the weekend after day 500. Data from the first 500 days were used to calculate control limits. Estimation of days to signal started at day 501. Days to signal for scenario A were: 375 (FS, Xbar), 217 (FS, cusum), >2500 (SI, I), and 210 (SI, cusum). Days to signal for scenario B were: 277 (FS, Xbar), 84 (FS, cusum), >2500 (SI, I), and 70 (SI, cusum). Days to signal for scenario C were: 291 (FS, Xbar), 151 (FS, cusum), >2500 (SI, I), and 137 (SI, cusum). We concluded from scenario A results that the probability density functions of the charted variables need to be better characterized as the estimated days to signal differed significantly from the design for 360 days. SI sample size for I chart was too small to detect the decline. As expected, cusum charts signalled sooner than Xbar or I charts for a persistent decline in estrus detection efficiency.

Key Words: Shewhart, Cumulative sum, Estrus detection

965   Comparison of AI pregnancy rates in dairy cattle by order of preparation of insemination straws. Greg Goodell*, *DUO Dairy Research Facility, Loveland, CO.*

This trial was conducted to evaluate the pregnancy rate by straw of an AI technician preparing more than 1 straw of semen at a time. It has become commonplace for some AI technicians on commercial dairies to prepare 2, 3 or 4 straws of semen for breeding simultaneously and then walk to the cows and breed the cows. This practice has increased dramatically on large dairies where there may be many cows to breed each morning or in facilities where AI materials and tools are not easily accessible from the cow pens. This trial was a retrospective study conducted on a 2500 cow dairy in Northern Colorado. All breedings being reported for this data were a result of a timed AI exposure to the cows through the utilization of a typical Ovsync program. Breeding results from one technician were analyzed for one hundred eighty cows. Regardless of the order in which the straws were applied to the cow they were all prepared together. They were thawed for 30-60 seconds in a thaw box where the temperature was maintained at 96 degrees Fahrenheit and promptly inserted into the insemination rod using standard AI

practices. The cow receiving the first straw of semen was labeled straw one, the cow inseminated with the second straw was labeled straw 2 and so on. Sixty-two cows were inseminated with the first straw, fifty-eight cows were inseminated with the second straw, fifty-three cows were inseminated with the third straw and seven cows were inseminated with the fourth straw. Pregnancy rates from the first straw to the fourth straw were 48.4%, 41.4%, 17.0% and 14.3% respectively. Since there were only 7 cows inseminated with a fourth straw the data was grouped with the data from the third straw for statistical analysis. Statistical analysis using oneway ANOVA yielded no statistical difference between the first and second straw but was highly statistically significant when compared to the third (p< .0009). The conclusion of this study was that cows bred with the third or fourth straw yielded much lower pregnancy rates than those bred with the first or second straw. The straw number is an indirect measure of time that the semen is exposed to the environment and emphasizes the fact that preparing more than 2 straws using the recommend methods for artificial insemination will result in lower pregnancy rates.

Key Words: reproduction, pregnancy rate by straw, ovsync

966   Effects of performance and physiological characteristics of dairy heifers on first lactation yield and lifetime performance.
M.L. Miller* and M.A. Faust, *Iowa State University, Ames.*

Data were heifer measures and yields for >5,100 Holstein cows in 121 herds. Heifer data included birth month and year, weights, breeding and calving ages, and sire Predicted Transmitting Ability (PTA) for milk, fat, protein and somatic cell score during 4 age categories (birth to: calving, 8, 11, and 65 wk). Health data were indicator variables for occurrence during each age category of scours, respiratory, digestive, reproductive, lame, injury and other health events. Separate models were run for the 2 yield response variables by using independent variables from the 4 age category subsets; thus a total of 8 different models were evaluated. Important independent variables from earlier age subsets were included in analyses for subsequent sets. Response variables were milk per day of calving interval for first lactation and milk per day of life from 24 mo. Overall, regression coefficients for a given independent variable were similar when the variable was included in analyses for different age subsets. Birth weights were important ($P < .01$) for both yield traits; coefficients for first lactation and lifetime yield, respectively ranged from .95 to 1.02 and .09 to .95.±142 kg/kg,. Coefficient for calving weight was important for lifetime yield only, but was smaller than birth weight coefficients for this variable (.055$\pm$0.008 kg/kg). Twins produced less first lactation and lifetime milk - estimates ranged from 6.78 to 24.4$\pm$5.07 kg.for single births and 4.24 to 19.59$\pm$17.41 for twins. Incidence of "other" health events was associated with less milk for first lactation (b-value=-7.86 to -10.9$\pm$3.03). However, health and twinning information were available for 3% of animals only. Sire PTA for somatic cell score was important for first lactation only, and indicated that daughters of sires with lowest score produced the most milk (-1.56$\pm$.3217 score/kg). Sire PTAs for milk were favorable; daughters of highest PTA milk sires produced the most milk, regardless of when PTAs were available for the heifer. Measuring traits such as birth weight in conjunction with genetic merit on heifers may be informative for culling future low producing cows.

Key Words: Milk-Production, Heifers, Prediction

967   Prepartum milking of Holstein heifers: III. Effects on lactation measures of production, reproduction and udder health.
J.F. Kearney*[1], M.M. Schutz[1], S.D. Eicher[2], and X. Li[1], [1]*Purdue University, West Lafayette, IN* , [2]*USDA-ARS, West Lafayette, IN.*

Several studies have looked at the effects of prepartum milking on heifers at time of calving. However, recent studies have not considered effects of prepartum milking on production, reproduction, and udder health over the entire lactation. The objective of this project was to investigate the effects of parlor exposure and pre-milking on behavior, production, and health parameters. Effects on Mature Equivalent 305d records of milk (MEM), fat (MEF) and protein (MEP), days to first service, days open, incidence of mastitis, and lactation average SCS are reported here. Forty-eight first-calf heifers, blocked by expected calving date, were randomly assigned to control (CTL), parlor exposure (EXP), or pre-milk (PRE) treatments. EXP heifers were taken through the parlor without

milking and PRE heifers were milked for three weeks prior to expected calving. Five heifers were removed from the trial for reasons unrelated to treatments and six heifers left the herd in early lactation and were not considered reflective of lactation measures. MEM, MEF, MEP and lactation average SCS were obtained from DHIA records. Days to first service, number of services, and days open were obtained from herd records. Mastitis incidence was obtained from herd health recordings. The model used to analyze the data included fixed effects of block and treatment. MEM at the time of first service was included as a covariable in the analysis of number of services. MEM, MEF, and MEP were not significant (P>0.05). Treatment did not effect days to first service but PRE heifers had significantly fewer (P<0.05) total services and days open. Earlier return to normal levels of haptoglobin for PRE reported in previous work may be related to quicker return to reproductive health. Treatment effects were not significant (P>0.05) for lactation average SCS or mastitis incidence. Results indicate no detrimental effects of prepartum milking on production and udder health and may indicate beneficial effects on reproductive performance.

Key Words: Prepartum milking, Heifers, Production

968   The influence of reproductive efficiency on income over feed costs in Holstein dairy herds in Ragusa Sicily.
J. D. Ferguson*[1], D. T. Galligan[1], S. Ventura[2], S. Barresi[2], G. Alderisi[2], and G. Licitra[2], [1]*University of Pennsylvania, University Park,* [2]*Consorzio-Ricerca Filera Lattiero, Sicily.*

A deterministic, spreadsheet model examined the relationship between reproductive efficiency and marginal income over feed cost (IOFC) in Ragusa Holstein dairy farms. Milk production was described for first and second parity animals based on production curves estimated from 12,946 Holstein records collected by the Ragusa DHIA. Milk production was adjusted for season of calving and two production levels for each parity group (LOW, 5,500, and 6,500 kg, HIGH, 7,500kg and >8,000 kg for parity 1 and 2+, respectively). The reproductive parameters were voluntary wait period (VWP) and pregnancy rate (PR), the multiplicative probability of pregnancy determined by the heat detection and conception rate. PR was varied in 11 steps (.10, .15, .20, .25, .30, .35, .40, .45, .50, .75, and 1.00) and VWP was 50 or 75 d postcalving. Dry matter intake was a function of days in milk, milk production, and average body weight at calving. The model used a sequence of 5 lactations beginning with first parity; reproductive efficiency determined length of production and season of future calving. Each lactation was terminated when a cumulative probability of pregnancy was > 99%. Dry period varied from 40 to 100 d as a function of lactation length. Cumulative IOFC was calculated as the income from milk (700 Italian Lire, (lr) x milk, kg) plus calves (200,000 lr/calf) minus the cost of feed for milk and dry cows. The cost of an average day open in Ragusa dairies was -5452.09 lr/cow/DOPN ($3.21, US) for low feed costs and -5187.26 lr/cow/DOPN ($3.05, US) for high feed costs. Higher production increased the loss per open day. Season of calving did not influence the cost of an open day, however milk production, VWP, PR, and feed cost influenced IOFC. It was always more profitable to have a higher PR regardless of season of calving.

Key Words: Days open, Economic efficiency, Pregnancy rate

969   Management of length of lactation and dry period to increase net farm income in a simulated dairy herd.
M.E. French*, M.L. McGilliard, and R.E. Pearson, *Virginia Polytechnic and State University, Blacksburg.*

A computerized dairy herd simulation was developed to evaluate the economic impact of changing length of lactation relative to length of dry period in a dairy herd. Weekly production was generated for individual cows in a typical herd. Cows were dried off early when their milk yield for two consecutive weeks was less than a designated daily milk yield. They were replaced with fresh cows to maintain a constant number of cows in milk (98 to 102). A two by four factorial of dry-off strategies was designed for rates of lactation decline of 6% and 8%/mo and milk at dry-off of 8, 13, 18, and 23 kg/d. There were 100 cows in each herd and each of the eight scenarios was run for 10 herds, 80 herds total. Sizes of dry cow groups for 8, 13, 18, and 23 kg/d dry-off were 14, 17, 23, and 32% of milking and dry herd size, respectively. Daily milk increased with earlier dry-off: 30.4, 31.2, 32.3, and 33.7 kg/d per milking cow, whereas rolling yearly herd average decreased. Three scenarios of milk income minus feed cost, (+20%, average, -20%) were combined

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with three dry cow costs, (+20%, average, and -20%). Nine combinations were analyzed statistically at each rate of lactation decline. Net cash income changed $+3561, $+1571, and $-3051/yr per herd from 8 to 13 to 18 to 23 kg/d dry-off for 8% decline under the average economic situation. Net farm income changed $+3170, $+2945, and $-1154. Under the best economic situation of high milk-feed income and low dry cow cost, net cash income increased with each successive increase in the dry-off criterion, $+5086, $+4248, and $+921. Net farm income also increased by $+4695, $+5621, and $+2819. Only in the most optimistic economic situations was it practical for a dairy business to adopt early dry-off above 13 kg/d per cow because other gains were small and variable. Dry-off at 18 and 23 kg/d was neither greatly profitable nor extremely unprofitable.

Key Words: Computer simulation, Lactation length, Net cash income

970   The interaction of a web-based dairy expert system and production benchmarks. A.M. Chapa*, J.W. Smith, L.O. Ely, M. Nakazawa, C. Ramakrishnan, and W.D. Potter, *University of Georgia, Athens*.

Dairy production benchmarks can be used to focus the initial point of inquiry for an expert system through the accumulation and analyses of data. Production benchmarks, calculated for Holstein herds in the southeast region, are used for screening measures of management efficiency. Herd records from the November and December 1998 test dates, accessed from the Dairy Records Management Systems, Raleigh, NC, were sorted and classified by herd size (up to 100, 100-149, 150-249, 250-499, and 500+ cows) and production level (14,000 - 22,000+ lbs in 1,000 lb increments), and categorized into management sections: production, feeding, somatic cell count, genetics, and reproduction. The univariate procedure of SAS was used to calculate percentile rankings (10, 25, 50, 75, and 90) based on herd size independent of production level. Additionally, means were calculated by production level independent of herd size for certain production variables. Values calculated from the percentile rankings and means by production level are placed into a database for use with an inference program for accessing the information to be used for analysis. A series of questions prompts the entry of herd data, available from the DHI 202 herd summary report, with the results displayed as a table showing the user values in relation to other herds and production levels. The evaluation may be continued into a specific area of management with additional questions regarding lactation groups and stages of lactation. Upon completion of data entry, simple mathematical calculations are used to identify possible problem areas. The results from the calculations are presented in a table and used to direct the types of questions asked by the expert system. By categorizing the user values and using simple calculations, the expert system will more efficiently identify areas of management for improvement and offer more reliable recommendations due to the initial evaluation of the producer information.

Key Words: Production benchmarks, Dairy management, Herd performance

971   Comparison of health parameters and milk production of cattle receiving an additional dose of E. coli. naked core antigen vaccine for the prevention of coliform mastitis during the third month of lactation. G. Goodell*, *DUO Dairy Research Facility, Loveland, CO*.

Naked core antigen vaccine is used in dairy cattle to reduce the number and severity of cows with coliform mastitis. This study was conducted to evaluate an additional dose of core antigen vaccine and the effect it may have on the health and production of a cow during the mid-lactation period. This clinical trial was conducted on a 2500 cow dairy farm in Northern Colorado. Cows were milked 3 times a day. Cows were housed in uncovered pens with freestalls. No first-lactation cows were used. Both treatment and control cows enrolled received 3 doses of vaccine. The first dose was given at dry off. The second dose was given approximately 3 weeks prepartum and the third was given 2 weeks post partum. A fourth dose was given to treated cows between 70 and 110 DIM. Cows were assigned randomly to treatment or control groups at the time of enrollment, which occurred at the time of the fourth dose. All cows within a group were enrolled simultaneously. Five hundred animals were used for his particular study. Cows were kept as a group in the same pen so that all management and exposure factors were the same. Cows were monitored for 90 days after enrollment. For this study the

treated cows decreased an average of 2 pounds of milk the day after the dose was administered relative to control cows but recovered completely within 48 hours. Daily milk production was measured over the following 90 days of the trial and found to be 1.6 pounds higher for treated cows during this time. The incidence of mastitis was the same for both groups during this period however treated cows recovered, on average, 2 days sooner from a case of clinical mastitis. The conclusion was that the fourth dose reflected in the treated group acted to decrease milk loss due to mastitis and reduced the severity of clinical mastitis. It was also shown to cause a drop in milk production the day after administration however the effects were greatly nullified by the overall daily increase of milk production in the treated cows throughout the rest of the study.

Key Words: Mastitis, core antigen vaccine, milk production

972   An investigation of the factors affecting the adherence of a dry cow teat sealant in commercial dairy herds in Ontario. G. H. Lim*, K. E. Leslie, D. F. Kelton, C. Church, and J. TenHag, *Univeristy of Guelph, Ontario, Canada*.

A dry cow teat sealant can be used for protection of the teat-end. The efficacy of the sealant is likely associated with the time in which the sealant remains on the teat. Quarter-level and cow-level factors affecting adherence of the sealant have been previously identified. The objective of the current study was to identify herd management factors that have an impact on the number of days the teat-end was covered, as well as further investigate the importance of teat and cow characteristics. A total of 45 dairy herds, representing a broad range of management characteristics typical of the Ontario dairy industry, participated in the study. On each farm, for a period of 4-6 months, all cows in the herd were enrolled in the study at the time of drying-off. Specific teat and cow characteristics were recorded, and all teats were dipped in the sealant (DryFlex®, Alfa Laval). Adherence was recorded at the teat level for 12 days. In addition, a herd survey was conducted to collect information on herd management practices specific to the time surrounding the dry period. Adherence data was collected from 733 cows. For the 2927 quarters, the average number of days teat-ends were covered was 5.3 ± 0.05 days. Adherence averages for the 45 farms ranged from 2.5 to 8.0 days. The standard deviation on each farm ranged from 0.5 to 3.8 days. The variation in adherence between cows within farms was more than twice that of the variation between farms. Ongoing statistical analysis will provide further information on the factors that significantly affect the outcome of days of teat sealant adherence. Measuring adherence is of practical use on a farm, since it is likely correlated to the efficacy of the sealant. The identification of herds with poor adherence results is also of importance. Management practices specific to such herds should be identified, so that they may be altered to effect an improvement in adherence. Alternate methods for improving adherence, such as dipping the teat twice in sealant, may also have a beneficial impact.

Key Words: Dry cow, Mastitis, Prevention

973   Association between heat stress prepartum, body condition score and production parameters of Holstein cows. L. Avendano-Reyes[1], J. W. Fuquay*[2], R. B. Moore[2], Z. Liu[2], B. L. Clark[2], and C. Vierhout[3], [1]*Instituto de Ciencias Agricolas, Universidad Autonoma de Baja California*, [2]*Mississippi State University*, [3]*Dairy Records Management Systems*.

To estimate the association between heat stress during the last 60 d prepartum, body condition score and certain productive traits in the subsequent lactation of Holstein cows, 564 multiparous and 290 primiparous cows from four dairy herds in Mississippi were used. Maximum prepartum degree-days and maximum temperature-humidity index were computed measures used to quantify the degree of heat stress. Cows were scored for body condition three times: at dry off, at calving, and at 60 d postpartum. Production variables were obtained from DHIA forms at the end of the lactation. Multiple regression analyses were used to determine the relationship between prepartum heat stress and body condition change on postpartum production parameters. In multiparous cows, maximum temperature-humidity index affected milk production at 200 d negatively. One point of decrease in body condition score from calving to 60 d postpartum was associated with 246 kg more milk. One point of increase in body condition score from calving to 60 d postpartum was associated with 1.85 kg of less milk at peak of milk production. There was no effect of heat stress measurements on postpartum production performance of primiparous cows. Due to

differences in management practices, herd effect was present in some productive variables for both primiparous and multiparous cows. Heat stress prepartum affected negatively milk production postpartum when it considered ambient temperature and relative humidity.

Key Words: heat stress, prepartum, production parameters

974   Association between heat stress prepartum, body condition score and reproduction parameters of Holstein cows. L. Avendano-Reyes[1], J. W. Fuquay*[2], R. B. Moore[2], Z. Liu[2], B. L. Clark[2], and C. Vierhout[3], [1]*Instituto de Ciencias Agricolas, Universidad Autonoma de Baja California,* [2]*Mississippi State University,* [3]*Dairy Records Management Systems*.

To estimate the association between heat stress during the last 60 days prepartum, body condition score and certain reproductive traits in the subsequent lactation of Holstein cows, 564 multiparous cows and 290 primiparous cows from four dairy herds in Mississippi were used. Maximum prepartum degree-days and maximum temperature-humidity index were computed measures used to quantify the degree of heat stress. Multiple regression analyses and logistic regression analysis were used to determine the effect of prepartum heat stress and body condition change on reproductive parameters, which were obtained from DHIA forms at the end of the lactation. Multiparous and primiparous cows which gained body condition score from calving to 60 d postpartum exhibited 29 and 27 less days open respectively. There was no effect of heat stress measurements on days open or services per conception in either multiparous or primiparous cows. During hotter months of calving, multiparous cows showed higher services per conception and primiparous cows showed higher days open and services per conception. Maximum prepartum degree-days were positively associated with calving difficult score, and maximum prepartum temperature-humidity index was negatively related to the same trait. Multiparous cows with higher body condition score at calving were 1.47 more likely to present a very difficult calving. Primiparous cows that calved in July were 1.69 times more prone to have a very difficult calving than cows that calved in October. Therefore, reproduction performance was apparently more affected by month of calving than heat stress prepartum.

Key Words: heat stress, prepartum, reproduction

975   Influence of environmental conditions on body temperature, dry matter intake, and milk yield for lactating cows from spring through summer in the southeast. J. W. West*, B. G. Mullinix, and J. K. Bernard, *The University of Georgia, Tifton.*

Thirty lactating cows (22 Holstein, 8 Jersey) with shade but no cooling were used to determine the effects of environmental conditions on body temperature, intake, and milk yield. The study was conducted from April 28 through July 21 when weather conditions typically change from warm to very hot and humid in south Georgia. Daily maximum and minimum temperature and relative humidity were measured and temperature-humidity index (THI) was calculated. Ambient temperature (^{o}C) mean (and range) minimum was 20.5 (range 9 to 26), maximum was 32.3 (range 23 to 38); relative humidity (%) minimum was 44.6 (range 25 to 78), maximum was 94.5 (range 77 to 100); THI minimum was 68.6 (range 50 to 77), maximum was 80.7 (range 69 to 89). There was a linear decline (P<0.0001) for milk yield across time which was much greater than normal decline with advancing lactation. There was a linear increase (P<0.0001) for p.m. body temperature which influenced DMI and milk yield. As THI increased, body temperature increased in a curvilinear fashion (P<0.0001), and a curvilinear decline for DMI and milk yield occurred (P<0.0001). Regressed on mean daily THI, at a THI of 72 and 76 cow p.m. body temperature (^{o}C) increased 0.143 and 0.187 (Holstein) and 0.122 and 0.168 (Jersey) per unit increase in mean THI; DMI (kg) decreased 0.319 and 0.502 (Holstein) and 0.278 and 0.426 (Jersey), and milk yield (kg) decreased 0.575 and 0.864 (Holstein) and 0.336 and 0.503 (Jersey) per unit increase in THI. Instantaneous slopes revealed that at THI of 72 milk yield declined at a rate of 0.221, 0.911, and 0.575 kg/unit increase in THI for Holsteins when regressed on maximum, minimum, or mean THI, respectively. Jerseys were more heat tolerant than Holsteins, warming environmental conditions had a curvilinear effect on body temperature, milk yield and DMI, and the environmental measure used influenced the magnitude of change observed for that variable.

Key Words: Heat stress, Intake, THI

976   A field study of dairy cow performance using different fan-cooling strategies. J.D. Sampson*, C. Bowe, J. Denbigh, M. Ellersieck, J.N. Spain, D. Spiers, and J. Zulovich, *University of Missouri, Columbia.*

Previous environmental chamber studies have shown that fan-cooling at night increases heat dissipation above the level of fan cooling during the day. A field study was performed to determine benefit of night-cooling under "real-world" conditions. Study duration was 6 weeks during the summer using 30 Holstein cows. Cows were blocked by lactation number and days in milk into two different pens. Pens had either 24 hr(T24)or 12 hr night-time fan cooling (T12), with lot conditions alternated every two weeks, equaling a study period. Milk weights were taken daily. Respiration rate, rectal and skin temperatures were taken 3 days per week(Monday, Wednesday and Friday)and three times per day(0800, 1400, and 2000hrs). Relative humidity (RH), temperature humidity index (THI), dew point and barn air temperatures were recorded every 15 minutes using a data logger(Onset). Treatments for Period 1 were not significantly different in milk yield. Mean THI and Ta with 95% confidence intervals (CI)for this period were 75.17(CI=77.02-77.39) and 26.65(CI=26.48-26,82C), respectively. Milk yields for T12 were significantly lower than T24 (P=0.0002)in Period 2, where THI and Ta were 77.21(CI=77.02-77.39) and 28.42C(CI=28.26-28.58C), respectively. In Period 3 T12 and T24 were not significantly different in milk yields, and ambient conditions were 73.44(CI=73.27-73.61) and 25.30C(CI=25.14-25.46C) for THI and Ta, respectively. Relationships between ambient conditions and milk yield showed best fit by third order polynomial regression. Noted breaking points for milk yield were as follows: Mean THI=77; Max THI=81.5; Mean Ta=28C; Max Ta=33C. These limits were only surpassed in Period 2, which explained the separation of T12 and T24 responses under these conditions. Above these critical breaking points, the decline in milk yield was greater for T12 compared to T24 groups. Twelve hour night cooling was as effective as twenty-four hour cooling for milk yield performance as long as critical ambient conditions were not reached or sustained.

Key Words: Heat Stress, Dairy Cow, Cooling

977   Effect on milk production of adding fans and sprinklers during hot weather on an Arkansas dairy farm. J. A Pennington*[1], J. M Langston[1], D. E. Kratz[1], and M. C. Andrews[2], [1]*University of Arkansas Cooperative Extension Service, Little Rock, Arkansas,* [2]*University of Arkansas Cooperative Extension Service, Clinton, AR.*

A demonstration was conducted to show the effects of adding sprinklers to the holding pen and fans to the feeding area on a dairy farm with 80 milk cows near Damascus, Arkansas, during hot, humid weather. A sprinkler system was installed on August 18, 1999, (day 0) between the am and pm milkings. A timer was installed three days later so that 0.1 cm of water was applied to cows in two minutes; fans then blew air over the cows for eight minutes to promote evaporative cooling and to complete the 10 minute cycle of the timer. Fans were previously in the holding pen, but fans without sprinklers were added to the feeding area where they operated continuously when cows were eating. The results shown below from the demonstration dairy (Demo D) and five nearby dairy farms (5 Dairy) which averaged 66.8 milk cows/herd indicate that milk production increased from cows after the sprinklers and fans were added to the management of the herd.

	Days -20 to -1	Days -10 to -1	Days 5 to 14	Days 5 to 24
	——	Milk Production/ Cow/Day	——	——
Demo D	19.3 kg	19.1 kg	22.0 kg	21.9 kg
5 Dairy	18.1 kg	18.0 kg	19.6 kg	19.3 kg
	——	Changes in Milk/	Days -10	——
	——	Cow/Day vs.	to -1	——
Demo D	+1.0%	0.0%	+15.5%	+15.1%
5 Dairy	+0.5%	0.0%	+8.4%	+6.5%

Key Words: Dairy, Cow comfort, Heat stress

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978   Effects of rbST on performance of Jersey cows in a thermal-stress environment. Z. Keister*[1], K Moss[2], R. Edling[3], R. Collier[1], and R. Ax[1], [1]*University of Arizona, Tucson,* [2]*Mountain Shadow Dairy,* [3]*Monsanto, Animal Agriculture.*

The objective of this trial was to measure effects of cooling and rbST on milk yield, reproductive performance and health of Jersey cattle during summer thermal stress. Cows were divided into two groups based upon days in milk, parity and genetic index. The control cows (n=143)were housed in a pen with no cooling other than shade. The second group (n=142) was housed in a pen with a spray and fan system, utilizing 10 fans, each set to deliver approximately 180 m3/m air and 0.84 l/m water for evaporative cooling. One half of the animals in each group were randomly assigned to be treated with rbST, with all animals at least 63 d in milk at the start of the trial. Cooled vs no cooled d in milk were similar (114.3 d vs 113.2 d) at the start of the trial. Both groups had the benefit of a holding pen cooling system for approximately 30 min each milking, 2X/d. Daily milk weights were taken using the S.A.E. Afikin milk recording system. The trial began on July 1, 1999 and concluded on September 30, 1999. The statistical design was a 2X2 factorial with cooling and rbST as main effects. Cooling in combination with rbST increased milk yield compared to no cooling and no rbST, (25.9 versus 23.2 Kg/d, P<.05). Cooling and rbST effects on milk yield were additive, furthermore, cooling was associated with reduced health problems in the cooled rbST animals when compared to animals with shade only, without rbST, respectively. Incidences of mastitis (5 vs 16, P<.01) and laminitis (2 vs 7, P<.05), were both reduced. Reproductive performance was improved in cows given access to cooling (126 pregnant and 6 abortions) versus shade only (112 pregnant versus 13 abortions) P<.05. Additional income over cooling cost was $.55/cow/day. Results indicated that cooling and rbST should maximize profit opportunity through increased milk yield, improved reproductive efficiency and reduced health costs.

Key Words: Thermal/Heat Stress, Cooling, Milk Yield

979   Productive and physiological response of Holstein steers under heat stress to an open space cooling system. A. Correa*[1], V. M. Ya'ez[1], A. P. Márquez[1], F. J. Verdugo[1], H. G. González[1], M. A. Tarazøn[2], D. V. Armstrong[3], J. C. Reynoso[4], R. Fregoso[4], and Z. Astarabadi[5], [1]*Universidad Autonoma de Baja California,* [2]*Universidad de Sonora,* [3]*University of Arizona, Tucson,* [4]*Corrales San Carlos, Mexicali, Mexico,* [5]*Open Space Cooling L. L. C..*

Thirty-two Holstein steers (initial weight 273 kg) were used to evaluate the effects of an open space cooling system on weight gain, feed intake and respiration rate during a hot summer in the Mexicali valley, Mexico. The duration of the trial lasted 90 d with a daily maximum temperature-humidity index (THI) range of 84-90.The steers were allotted in two treatments according to their body weight. A control group (C) with shade only in the center of the pen (n=16) and a second group (n=16) with shade plus an open space cooling system (OSC). The open space cooling system consisted of a fan with 2.4m diameter blade that circulates 1416m^3 of air/min and oscillation coverage of 90°. The amount of water discharged was 12 l min^{-1}. Weight gains were recorded biweekly and feed intake and respiration rate (14:00 h) twice weekly. Data were analyzed as a completely randomized design using the general linear model procedures of SAS. There was not significant difference in daily weight gain and feed intake, however the tendency to increase the productive performance and the reduction in the respiration rate in the steers under the cooling system indicate an improvement in their comfort and suggest that further study about these environmental modifications.

Treatment	Weight Gain (kg d^{-1})	Feed Intake (kg d^{-1})	Respiration Rate (breaths min^{-1}
Control	1.34[a]	11.1[a]	104[a]
OSC	1.41[a]	11.8[a]	89[b]

[a,b] (P<.05)

Key Words: Heat stress, Steers, Cooling system

980   A comparison of freestall barns used by modernized Wisconsin dairy farms. J. Bewley*, R.W. Palmer, D.B. Jackson-Smith, and D.E. Hemken, *University of Wisconsin, Madison.*

A primary objective of the Wisconsin dairy modernization survey was to compare options available to dairy producers related to types of freestall barns. Three hundred two herds that had increased herd size by a minimum of 40% between 1994 and 1998 were selected for this study. Comparisons were made for new versus remodeled facilities, barn design, bedding used, feeding strategy, manure removal systems, and animal handling facilities. Among respondents using freestall barns as their primary housing for the milking herd, 67% had new freestall facilities, 10% had remodeled facilities, and 23% had both new and remodeled facilities. Satisfaction with cow comfort, cow cleanliness, ability to move animals, manure management, and feeding convenience was higher for respondents using new facilities compared to those using remodeled facilities (P<0.05). Approximately 40% had 4-row barns, 25% had 3-row barns, 23% had 6-row barns, and 7% had 2-row barns. Labor efficiency was higher for 4-row and 6-row barns than for 2-row and 3-row barns. The most predominant freestall bases were sand (60%) and mattresses (29%). Average linear somatic cell score did not differ between respondents using mattresses and sand (P<0.05). Respondents using sand reported greater satisfaction with cow cleanliness and hock damage, and respondents using mattresses were more satisfied with manure management and bedding usage and cost (P<0.05). Feeding strategies included drive-through feeding (64%), drive-by feeding (18%), and outside feeding (8%). Respondents using drive-through feeding were more satisfied with feeding convenience than those using drive-by or outside feeding. The majority (78%) of respondents used tractors to remove manure while the remaining respondents used alley scrapers (11%), slatted floors (7%), or flush systems (2%). Respondents using alley scrapers and slatted floors were more satisfied with manure management and bedding usage and cost than those using only a tractor to remove manure (P<0.05).

Key Words: freestall, survey, expansion

981   A controlled study on the effect of free-stall alley surface and stall bedding on hoof and hock lesions in lactating Holstein dairy cattle. F.J. Vokey*, C.L. Guard, H.N. Erb, and D.M. Galton, *Cornell University, Ithaca, NY.*

A 15-wk 3 x 2 factorial trial in a 400-cow university herd compared effect of 3 free-stall beds and 2 alley surfaces on hind hoof and hock lesions. Stalls were deep sand (S), multi-cell rubber-filled mattresses (M), or concrete (C). Mattress and concrete stalls were bedded with sawdust. Alley surfaces were parallel-grooved concrete (Ct) or 1.9-cm thick interlocking rubber mats (Rb). Prior to assignment, 120 primi- (n=69) and multiparous (n=51) cows were restrained on a tilt-table, professionally foot trimmed, and then scored by a veterinarian (CLG) for lesions in the sole and white line. Exclusions were for less than 30 DIM, more than 115 d pregnant, severe hoof or leg deformities, or severe laminitis. Cows were sorted by lesion score and then randomized in consecutive blocks of 3 to stall treatments. Due to animal availability, the Rb treatment began 31 d before the Ct but management was the same and stalls were reconstructed to identical dimensions. Hocks were scored non-blindly at wk 1 and 15; the change in score was calculated. After wk 15, a thin layer of horn was pared from the sole. The same veterinarian (blind to stall treatment) scored claws for lesions; the change was calculated. Days spent out of the assigned pen for health reasons were recorded. Analysis was performed using rank-sum, Kruskal-Wallis, and χ^2 tests. Hoof score increased in all groups but less on Rb (P=0.02). Hoof score did not differ by stall treatment. CtC cows had a greater increase in hock score than cows in CtS and RbS (P=0.0003). Hock scores increased less for cows in S than in M and C (P=0.0001). More cows from Ct and C spent more than 10 days out of the assigned pen than from Rb (P=0.05) and other stall groups (P=0.02), respectively. Rubber floors in free-stall barns were protective for hoof lesions compared to concrete. Consistent with other studies, deep sand stalls were most protective for hock lesions.

Key Words: Hoof Lesion, Hock Lesion, Free-Stall Design

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982 Measuring water use in California dairy facilities. C. Batchelder[1], I. Zallo[2], B. Reed*[1], and D. Meyer[2], [1]University of California Cooperative Extension, [2]Department of Animal Science, University of California, Davis.

Meters were installed on fourteen (14) dairy facilities in the Central Valley of California to measure water use during milking and to calculate the contribution to 120 d liquid storage capacity requirements. Cow drinking water was excluded from calculations. Dairies were categorized as small (<450 milk cows) or large (>650 milk cows). Small herd sizes ranged from 125 to 445 milk cows. Large herd sizes ranged from 691 to 1287 milk cows. Average herd sizes by category were: 309 and 945. Use per cow was calculated by dividing total metered water use by cows milked. Range, average and standard deviation for water use (l/cow/d) in small herds were: 167 to 420, 269, 98. Ranges, average and standard deviations for water use (l/cow/d) in large herds were: 204 to 261, 231, 49. Ranges for the 120 d liquid storage capacity (m^3) contributions from water used during milking were: 2821 to 15,511 and 20,240 to 31,743 for small and large herds respectively. One dairy reconfigured sprinkler pens and reduced water use per cow by 129 l/d. Dairies can benefit from water monitoring and conservation efforts. Reducing water use can decrease storage requirements significantly.

Key Words: Water, Conservation, Storage

983 Factors affecting the estimation of time spent on essential work routine elements in dairy parlors. N.R. St-Pierre*, The Ohio State University, Columbus.

A significant proportion of total labor costs on US dairy farms occurs in the dairy center. An electronic data logger was designed to estimate the amount of labor time spent on each of the seven essential work routine elements (EWRE) and on various non-essential activities during milking. The logger was used to record the activities of milkers in 25 Ohio milking parlors varying in size from double 8 to double 16. On the day of the visit, the farm was also evaluated for a wide variety of criteria thought to influence cow throughput. Criteria included types of housing, types of bedding, stall designs and cleanliness, experience and training of milkers, elements of the work routine (e.g. spray or dip), equipment characteristics, cow characteristics, and grouping strategies. Additionally we evaluated the effect of the level of experience with the data logger and the length of the logging session on the accuracy of results as well as the effect of the session on the repeatability of the results. A bootstrap procedure was used to estimate the length of data recording necessary to estimate mean EWRE times with errors of at most 10%. Results showed that estimated mean EWRE times were within 10% of the true mean 95 % of the time after the recording of six consecutive cycles. The level of experience of the person doing the data recording had a significant effect on accuracy. Data recorded during the first two sessions following the initial training had significantly larger variances (P<0.05) than data from the following sessions. Many factors outside the milking parlor impact significantly on cow throughput and labor efficiency in the parlor.

Key Words: Milking Parlor, Labor Efficiency, Essential Work Routine Elements

984 Manure sampling for improved nutrient management on animal farms. Z. Dou[1], R. Allshouse*[1], J. Toth[1], R. Boston[1], and J. Ferguson[1], [1]University of Pennsylvania, Kennett Square.

One of the Best Management Practices in animal manure management is to formulate manure application rates based on manure nutrient content and availability and crop nutrient requirements. However, when conducting manure sampling for nutrient analyses, one question often arises: how many samples are needed in order to get a good representative sample? We investigated this issue with a statistical approach by combining intensive sampling and sample analyses with a computer program. We took serial samples from three dairy farms (Farms A, B, C) and a broiler operation (Farm D); the dairy samples were collected periodically during the course of emptying the manure storage, the broiler samples were taken from multiple locations of litter piles prior to the manure hauling. Total number of samples (designated as the **grand sample set**) is: 34, 35, 20, 32 for farms A, B, C, D, respectively. All samples were analyzed for DM and concentrations of total P, TKN, and NH4; the means of these parameters were obtained for each farm and designated as the **grand means**. A computer resampling procedure was used to randomly withdraw, from the grand sample set, subsets of 3, 5, or 10 samples, each set for 10,000 times (designated as the **resampling set**). Means of the parameters were obtained for the resampling sets (designated as the **resampling means**), which were compared with the relevant grand means. Finally, the frequency at which the resampling means fell within ±5, 10, or 15% of the grand means was determined. For all four farms, the frequency of resampling means falling within ±5, 10, 15% of the grand means increases as the size of the resampling (3, 5, or 10) increases. At the ±5% level, the frequency varies a great deal among the four farms, ranging from 35% of the time to as high as 100% of the time. At the ±10% level, the frequency was >74% for all the parameters across the four farms. Implications of this study on manure sampling will be discussed.

Key Words: Sampling, Manure, Nutrients

985 Implementation of innovative best management practices and a nutrient monitoring system to reduce nitrogen and phosphorus loading from dairy cattle production systems. G. M. Goodall*[1], M. A. Tomaszewski[1], E. R. Jordan[2], S. R. Stokes[3], and L. W. Greene[4], [1]Texas A & M University, College Station, [2]Texas A & M Research and Extension Center, Dallas, [3]Texas A & M Research and Extension Center, Stephenville, [4]Texas A & M Research and Extension Center, Amarillo.

The objective of this study was to monitor the environmental effects from dietary nitrogen and phosphorus loading via ration management. The potential impact of elevating nitrogen and phosphorus in the environment from application of wastewater and manure is a significant concern to the dairy industry. Overfeeding degradable protein can upset normal rumen function and result in excess nitrogen being excreted into the environment. Similarly, overfeeding phosphorus can result in soil accumulation. During the course of 18 months, eight (8) Texas cooperator herds were monitored through monthly feed, fecal and milk samples. Daily bulk tank samples were obtained to determine milkfat, protein, MUN (Milk Urea Nitrogen), somatic cell count, nitrogen, phosphorus and trace minerals. The cooperators were selected to represent pasture-grazing herds and Total Mixed Ration (TMR) fed herds. Overall ration phosphorus levels averaged 0.54% (SD = 0.122), while ration protein averaged 18.49% (SD = 2.24). Fecal nitrogen levels averaged 2.67% (SD = 0.258), while the fecal phosphorus averaged 1.03% (SD = 0.165). The MUN levels averaged 14.6 mg% (SD = 2.26). The rations were evaluated and reformulated using the Cornell Net Carbohydrate and Protein Model to compare the nitrogen and phosphorus levels. The feeding system significantly effected MUN, peak milk and fecal nitrogen. The grazing herds had significantly higher MUN levels and significantly lower peak milk production. Fecal phosphorus levels were significantly effected by ration phosphorus. This data indicates the need to monitor and adjust intake of protein and phosphorus.

Key Words: Dairy-cows, Environment-nitrogen and phosphorus, Monitoring-milk, fecal, MUN

986 Management effects on nutrient loading and losses from dairy farms. C. A. Rotz*[1], A. N. Sharpley[1], and L. D. Satter[2], [1]USDA/ARS, University Park, PA, [2]USDA/ARS, Madison, WI.

Management decisions can impact the long-term sustainability of dairy farms. Computer models provide useful tools for evaluating these impacts before they are implemented. A representative farm with 400 Holstein cows (producing 11,000 kg/cow/yr) and their replacements on 300 ha of silt loam soil was simulated over 25 yr of Pennsylvania weather using a whole farm model (DAFOSYM). Multiple simulations predicted the effects of animal density, herd production, and feeding strategy on N loss, P balance, and farm profit. Reducing the land area to 200 ha nearly doubled N losses and increased soil P accumulation by 15 kg/ha/yr with little change in farm profit. At 400 ha, the farm was near a long-term P balance with an N fertilizer requirement of 50 kg/ha. A 10% increase in herd production through the use of BST provided a small increase in N loss and soil P level; whereas, a 25% drop in production reduced N losses 10% and P buildup by 3.6 kg/ha/yr. Changing the breed to Jerseys while increasing animal numbers to maintain the same sale of fat corrected milk increased N losses 45% with a small increase (1.8 kg/ha/yr) in excess P. Compared to soybean meal as the sole protein feed, including a low RDP feed in rations reduced N volatile loss 35%,

reduced N leaching loss 20%, and increased production and profit with little effect on soil P. Increasing the feeding of P to 20% above the NRC recommended level (common practice) increased the long-term buildup of soil P by 8 kg/ha/yr; whereas, a 20% reduction provided concurrent farm balances of both N and P. Shifting from low forage rations to maximum use of forage increased the purchase of alfalfa hay and reduced grain imports, which increased N losses slightly with little effect on P balance and farm profit. Changing from a corn and alfalfa rotation to all corn reduced N volatilization loss 14% and increased leaching loss 22% with little effect on soil P. For further analysis of dairy production systems, the DAFOSYM software is available at the Internet address http://pswmrl.arsup.psu.edu.

Key Words: Dairy farm, Nutrient management, Economics

987   Methods of processing affect absorption of IgG from colostrum supplement products in neonatal calves. J. D. Quigley*, M. L. Miller, and C. A. Jaynes, *American Protein Corp., Ames, IA.*

Provision of an adequate mass of IgG within the first 24 h of life is essential to health and survival of neonatal calves. Maternal colostrum (MC) may provide inadequate amounts of IgG for successful passive transfer; therefore, colostrum supplement products (CSP) have been developed. However, apparent efficiency of IgG absorption (AEA) from many CSP is poor. Methods of preparation may influence absorptive kinetics of IgG in CSP. Our objective was to determine if methods of processing influence absorption of IgG from CSP. The CSP were prepared by collecting, processing and spray drying edible grade bovine serum (BS1) or further processing bovine serum by three methods (A, B, or C) to increase IgG concentration of the final CSP to approximately 27% IgG. Holstein bull calves (n = 80) were used in the study. Calves (birth BW = 43.8 kg) were removed from the dam within 5 min of birth and were fed CSP or MC within 2 h. All CSP were reconstituted in 1.89 L of water and 454 g was fed at approximately 1 h and at 8 h (BS1 only). Blood was collected by jugular venipuncture, plasma IgG was determined by turbidimetric immunoassay at 0.3 and 24 h of age and AEA was calculated. Plasma IgG at 24 h of age was lowest in calves fed BS1; plasma IgG in calves fed CSP did not differ from concentrations in calves fed MC. Mean plasma IgG at 24 h were 10.3, 4.1, 9.4, 9.1 and 9.8 in calves fed MC, BS1, CSP-A, CSP-B, and CSP-C, respectively. Intakes of IgG were 100, 95, 119, 119, and 119 g, respectively. Mean calculated AEA were 38, 16, 31, 29 and 32%, respectively and were lower in calves fed BS1. Method of preparing BS1 (removal of lipid from serum prior to spray drying) reduced plasma IgG concentration and AEA. Further processing serum to produce CSP did not impair absorption of IgG or AEA. Method of processing can significantly impact efficiency of IgG absorption from CSP. Provision of IgG to prevent failure of passive transfer is possible with CSP containing >20% IgG and fed at 454 g per dose.

Key Words: Calves, Colostrum, Immunoglobulin

988   Effect of pH on IgG absorption in neonatal calves. J. D. Quigley*[1], R. E. James[2], and P. French[2], [1]*American Protein Corp., Ames, IA,* [2]*Virginia Tech, Blacksburg.*

Formulation of colostrum supplement products (CSP) may influence the absorption of IgG and apparent efficiency of IgG absorption (AEA). The pH of maternal colostrum (MC) is approximately 6.0; the pH of most CSP are significantly greater than 6.0. The AEA from some CSP is poor; it is not clear if differences in pH between MC and CSP might be responsible for observed differences in absorption kinetics of CSP. Our objective was to determine if differences in pH influence plasma IgG and AEA in CSP fed to neonatal calves. Newborn calves (n = 60) were fed MC (n = 12) or a CSP derived from edible bovine serum (n = 48; Lifeline Calf Nutritional Colostrum Supplement, American Protein Corp., Ames IA). Holstein (n = 45) and Jersey (n = 15) calves were used. Sodium citrate was added to CSP to achieve pH in product of 7.5, 7.0, 6.0 and 5.0. Calves were collected prior to nursing, weighed, moved to individual pens and fed pooled colostrum (2 L/feeding) or CSP (454 g reconstituted in 2 L of water) at 1.2 and 12.6 h of age which provided a total of 156 (MC) or 90 (CSP) g of IgG. Jugular blood was sampled at 0 and 24 h of age for determination of plasma IgG by turbidimetric immunoassay. Mean plasma IgG concentrations at 0 and 24 h of age were 0 and 6.7 g/L and were markedly higher in calves fed MC compared to CSP (10.7 vs. 6.5 g/L) and were higher in Jersey vs. Holstein calves (8.5 vs. 6.1 g/L). Mean plasma IgG at 24 h were 10.7, 6.6, 6.5, 5.8, and

7.2 g/L for calves fed MC and CSP at pH = 7.5, 7.0, 6.0 and 5.0, respectively. Mean AEA were 21, 19, 20, 17 and 24%, respectively. All calves were fed by esophageal feeder, which may have reduced AEA. Mean calf mortality and number of days treated for enteric or respiratory disease to 60 d of age were unaffected by treatment and were 16.7% and 1.4 d, respectively. These data indicate that pH of colostral supplements between 7.5 and 5.0 do not markedly influence plasma IgG concentration or AEA.

Key Words: Calves, Colostrum, Immunoglobulin

989   Effects of accelerated milk replacer feeding at 2 protein levels on performance and economics in Holstein heifer calves. D. R. Catherman*, *Strauss Feeds, LLC, Watertown, WI.*

Ninety six Holstein heifer calves (average 40.2 kg BW) were utilized in a study to evaluate the effects of milk replacer (MR) protein level and feeding rate on performance and economics. Calves were allotted by weight to one of four treatment groups. Calves were fed MR (20% fat) as follows: treatment 1, 20% protein at 454 g/d; treatment 2, 20% protein at 568 g/d; treatment 3, 22% protein at 454 g/d; and 22% protein at 568 g/d for 28 d. MR feeding rate was reduced to either 228 or 284 g/d for d 29 to 35. Calves were weaned on d 35 and feed intake was recorded for 42 d. Water and starter grain (18% protein) were offered free choice from d 3. Total MR intakes were 13.5, 16.9, 13.5, and 16.9 kg for treatments 1 through 4, respectively. No differences were observed in weight gains between 0 and 21 d and between 21 and 42 d, although the calves fed 22% protein tended to gain more weight. Overall weight gain (0 to 42 d) was higher (P<.05) for treatments 3 (25.3 kg) and 4 (26.0 kg) than treatment 2 (20.3 kg). Treatment 1 was intermediate (24.5 kg). Total starter intake was lower (P<.05) for treatment 2 (23.5 kg) than for treatments 1 (33.9 kg), 3 (32.8 kg), and 4 (31.5 kg). Feed to gain ratio was lower (P<.05) for treatment 3 (1.83) than for treatment 2 (1.99). Treatments 1 (1.93) and 4 (1.86) were intermediate. Feed cost per kg of gain was lower (P<.05) for treatments 1 ($1.23) and 3 ($1.17) than treatment 2 ($1.63). Treatment 4 ($1.63) did not differ from the other treatments. Scour scores and cost and number of medical treatments were not different between groups. Based on these data, increasing protein content of MR from 20 to 22% improves gain slightly. Increasing feeding rate increases cost per kg of gain and resulted in only a slight increase in gain at 22% protein, and a decrease in performance at 20% protein. More work is needed to define the effects of higher MR feeding rates on performance and economics in Holstein heifer calves.

Key Words: calves, milk replacer, feeding rate

990   The impacts of management factors on the costs of replacement dairy heifer programs. P. R. Tozer, *The Pennsylvania State University, University Park.*

A dynamic programming model of a dairy replacement herd was developed to analyze the impact different management variables had on the cost of rearing replacements for a representative dairy herd of 100 cows. A base herd dynamics model was developed using Pennsylvania and national average information as the basis for the parameters included. Using the base model for comparison, the impact of management factors including: age at first calving; calving interval; number of replacement heifers born; pre-weaned heifer death rate; pregnancy rate of replacement heifers; and the number of replacements required; was examined. From the base model and using a value of $1200 per heifer, the total cost of rearing sufficient replacements for a 100 cow herd was $30934 with a pre-weaned heifer culling rate of 5%. Of the management factors examined the age at first calving and the number of replacements required had the largest impact on the costs of rearing replacements for the milking herd. A higher than average age at first calving increased the cost of rearing by 9% and a lower than average age at first calving reduced the costs by 18%. A relatively high replacement rate caused the costs of rearing replacements to rise by 20%, whereas a relatively low rate reduced the costs by 23%. Parametric programming determined the value at which the farmer would retain all heifers until after they calved is approximately $1600.

Key Words: mathematical programming, replacement management, economics

991 Predicting body weight in Holstein heifers using pelvic width measured between greater trochanters of the femurs. A. L. Skidmore*[1], C. J. Sniffen[2], and K. Ballard[2], [1]*Attica Veterinary Associates, PC, Attica, NY,* [2]*W. H. Miner Agricultural Research Institute, Chazy, NY.*

The purpose of this study was to evaluate if measuring pelvic width, the distance between the greater trochanter on the left and right femurs, was predictive of body weight in Holstein heifers. Pelvic widths and body weights were measured on 240 heifers. Pelvic widths were measured to the nearest 0.5 cm. Body weights were recorded with electronic scales at the same time pelvic widths were measured. Body weights ranged from 55 kg to 355 kg. Pelvic widths ranged from 21.0 cm to 43.5 cm. A linear model, least square means analysis indicated that hip width is a significant predictor of body weight (P<0.0001). Ninety-three percent of the variation in body weight was explained by hip width ($R^2=0.927$). Hip width and body weight have a linear relationship within the weight range represented by this data set. Adding a quadratic term to the model only slightly increased the Rsquare ($R^2=0.934$). This would indicate that the relationship between hip width and body weight might not be linear when data from a larger range of body weights are included in the model. In conclusion, pelvic width is predictive of body weight in 55 kg to 355 kg Holstein heifers when measured as the distance between the greater trochanter on the left and right femurs.

Key Words: Heifers, Hip width, Body weight

992 Effects of monensin and lasalocid on growth, feed intake, and feed efficiency in dairy calves. J.A. Isch*[1], J.E. Shirley[1], M.V. Scheffel[1], E.C. Titgemeyer[1], and E.E. Thomas[2], [1]*Kansas State University, Manhattan,* [2]*Elanco Animal Health, Greenfield, IN.*

One hundred Holstein heifers were used to examine the effects of monensin (Rumensin/[®]) and lasalocid (Bovatec[®]) included in calf starter and grower diets. Heifers were assigned alternately at birth to a starter feed containing either monensin (31 mg/kg, 90/% dry matter basis) or lasalocid (44 mg/kg, 90/% dry matter basis). The lasalocid group was switched to a starter feed containing 31 mg lasalocid/kg (90/% dry matter basis) at 6 weeks of age. Both groups were switched at 8 weeks of age to grower diets designed to deliver 100 mg/heifer daily of either monensin or lasalocid. No treatment differences were observed between birth and 8 weeks of age. Heifers were moved from individual hutches at 8 weeks of age to group pens (five heifers/pen) and remained on the same treatment for the next 84 d. Pen feed intakes were measured and used to evaluate DMI differences. During this 84-d period, heifers receiving monensin gained more weight (P=.02) at a faster rate (P<.01) and tended to be more efficient (P=.22) than heifers fed lasalocid. No differences were observed in feed intake, skeletal growth as measured by hip height, or body condition score.

Key Words: Replacement Heifers, monensin, lasalocid

993 Assessment of the economics of Megalac[®] use by computer simulation. M. L. Kinsel*[1], W. K. Sanchez[2], and E. Block[2], [1]*Agricultural Information Management, Nampa, ID,* [2]*Church & Dwight Company, Inc., Princeton, NJ.*

Feeding calcium salts of fatty acids (CSFA), such as Megalac[®], has been shown to protect rumen microbes from the adverse effects of fat and may lead to higher production levels, improved fertility, and reduced dry matter intakes. Despite the evidence of potential benefits in addition to increased milk production, no studies have attempted to quantify the overall economic return of CSFA use to the dairy enterprise. The objective of this study was to estimate by computer simulation the six year economic return of Megalac use given differing effects on milk production, reproductive performance, and dry matter intake. Ten simulation runs each were conducted for three levels of milk production effects, three levels of first service conception rate effects, three levels of second or higher service conception rate effects, and two levels of dry matter intake effects plus a baseline scenario for a total of 550 simulation runs. Megalac was simulated to be fed at 2.2% of the total ration dry matter at a cost of $800 per dry matter ton for cows that were producing more than 36.3 kg of milk. For each simulated run an annualized six year annuity value was calculated. Statistical analysis consisted of multiple linear regression of the annuity value by changes in milk response, changes in reproductive effects, and changes in dry matter intake. All

effects (increasing milk production, improving first service conception rate, improving second or higher service conception rate, and reducing dry matter intake) led to statistically significant improvements in economic return ($R^2 = 0.96$). The largest unit return was related to improving milk production one kg/cow/d ($56.36 annual return per cow), followed by reducing dry matter intake one kg/cow/d ($29.37 annual return per cow), improving second or higher service conception rate one percent ($4.08 annual return per cow), and improving first service conception rate one percent ($2.28 annual return per cow), respectively. Based on effects reported in early lactation and reproductive studies, the annual profit per cow from Megalac use would be $190.68.

Key Words: Economics, Calcium Salts of Fatty Acids

994 Evaluation of feed additives in the diet of lactating dairy cows. R.H. Phipps*[1], J.D. Sutton[1], D.E. Beever[1], M.K. Bhat[2], G.F. Hartnell[3], J.L. Vicini[3], and D.L. Hard[3], [1]*Centre for Dairy Research, The University of Reading, UK,* [2]*Institute of Food Research, Norwich, UK,* [3]*Monsanto Company, St Louis, MO.*

Holstein-Friesian cows (86 multiparous and 37 primiparous) were used in an 16-week continuous design study to determine the effect of three additives on feed intake and milk production. At lactation week 5 animals were allocated to four treatments: T1 (control no additive), T2 (Additive D), T3 (Enzyme A) or T4 (Enzyme B). The TMR fed contained 57% forage (maize and grass silage 3:1 DM ratio) and 43% concentrate with a CP, NDF, NSC and TDN content of 20.3, 34.5, 36.3 and 66.8% DM. The xylanase and endoglucanase activity of Enzymes A and B were 38,883, 6,914 and 26,483, 2,645 mol/min/g. Additive D contained soluble sugars and dicarboxylic acids. Cows allocated to T2 received 0.227 g Additive D/20 kg DM of TMR, while those on T3 and T4 received the TMR treated with either Enzyme A, applied to forage at 1.25 l/t of forage DM, or Enzyme B at 2.0 l/t of total DM. There was no parity x treatment interaction and no significant treatment effect on DM intake with mean values for cows and heifers being 20.4 (s.e.m. 0.29) kg DM/d and 16.3 (s.e.m. 0.44) kg DM/d. Mean milk yields for cows for T1-T4 were 30.3, 30.8, 29.9 and 31.2 (s.e.m. 0.56) kg/d, with corresponding values for heifers of 26.0, 26.1, 25.9 and 26.4 (s.e.m. 0.83) kg/d. Whilst there was no significant effect the increase of 0.9 kg/d when comparing the control with Enzyme B for cows is noted. Treatment effects on milk composition were not significant. Milk fat and protein values for cows for T1-T4 were 4.05, 3.88, 4.04 and 3.91 (s.e.m. 0.116)% and 3.41, 3.39, 3.40 and 3.36 (s.e.m. 0.035)%. Corresponding values for heifers (3.85, 3.89, 3.63 and 3.45 (s.e.m. 0.173)% milk fat and 3.26, 3.29, 3.29 and 3.36 (s.e.m. 0.053)% milk protein) also showed no significant effects. However the decline in milk fat content of heifers receiving Enzyme B suggests changes in pattern of rumen fermentation. The results of the current study showed that the inclusion of the additives produced only small and non significant effects on feed intake, milk yield and composition.

Key Words: Cell-wall degrading enzymes, Feed intake, Milk production

995 Effect of cell-wall degrading enzymes and method of application on feed intake and milk production of Holstein-Friesian dairy cows. R.H. Phipps*[1], J.D. Sutton[1], D.E. Beever[1], M.K. Bhat[2], G.F. Hartnell[3], J. Vicini[3], and D.L. Hard[3], [1]*Centre for Dairy Research, The University of Reading, UK. ,* [2]*Institute of Food Research, Norwich, UK.,* [3]*Monsanto Company, St Louis, MO.*

Fifty-one multiparous and nine primiparous Holstein-Friesian dairy cows in mid lactation were used in a ten week continuous design trial to determine the effect of method of application of cell-wall degrading enzymes on feed intake and milk production. All cows received ad libitum the same TMR containing, on a DM basis, 57% forage (maize and grass silage in a 3:1 ratio) and 43% concentrate. The CP, NDF, ADF, NSC and TDN values of the TMR were 18.6, 50.6, 34.6, 18.9 and 68.8% DM. There were three treatments: T1 was a control ration with no enzyme, T2 had enzyme added to the TMR during mixing (2 l/t of TMR DM), and T3 had enzyme added to the concentrate prior to mixing (5.1 l/t concentrate DM). Treated concentrate was prepared weekly. The xylanase and endoglucanase activities of the applied enzyme were 26480 and 2640 umol/min/gram of the enzyme. As there were no treatment x parity interactions data are presented for all animals. Respective means and s.e.m for T1-T3 were 17.8, 18.2, and 18.6 (0.42) kg/d for total DM intake, 26.6, 27.4 and 26.9 (0.42) kg/d for milk yield, 3.97, 3.88 and 3.95

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(0.123) for fat%, 3.42, 3.36 and 3.47 (0.036) for protein%. Enzyme application and its method of application had no significant effect on DM intake and milk production These results are at variance with recent papers indicating the application of cell-wall degrading enzymes can result in increases in feed intake and/or milk production. The differences may be due to a number of factors including type and rate of enzyme application, optimal conditions for enzyme activity and diet composition. Further work is needed to determine the effect of enzymes on feed intake, milk production and feed quality.

Key Words: Cell-wall degrading enzymes, Feed intake, Milk production

996   Rumen-stable choline use in transition dairy cows improves early lactation milk yield. J. Siciliano-Jones[1] and D. Putnam*[2], [1]*F.A.R.M.E Institute, Homer, NY,* [2]*Balchem Corporation.*

Six sites were used to determine the effects of rumen-stable choline (RSC) (Reashure[TM] choline, Balchem Corporation, Slate Hill, NY), fed to transition dairy cows, on early lactation milk yield. The trial began in January, 1999 and continued through August, 1999. The trial was conducted in the following design: control period, treatment period, control period. All prefresh (approximately 21 to 0 d precalving) and early postfresh (approximately 0 to 40 DIM) cows were either in the control or treatment period. Treatment consisted of supplementing 60 g of RSC per cow per day. Periods were approximately 40d in length. Cows were coded as RSC-supplemented only if their fresh date was at least 3 weeks after RSC feeding began. Cows were coded as controls if their fresh date was at least 20 days after the end of RSC feeding. The initial control period was defined as a period of time equal to the RSC-feeding period that occurred prior to initiation of RSC feeding. The mixed procedure in SAS[®] was used to determine treatment effects on monthly milk weights. Data were analyzed independently at each site. Independent variables were cow, treatment, observation, and test date. Observation was defined as test date minus January 1, 1999 and treated as a repeated factor. Fixed factors were treatment and test date; cow was random. Parity and DIM served as covariates. A total of 816 observations were collected for RSC fed cows and 1444 for unsupplemented controls. Treatment by test date interactions were not significant (P>.05) and were pooled into the error term for all locations. Supplementation with RSC significantly (P < .05) increased milk production at 3 of the 6 sites; milk yield averaged 40.9, 34.8, and 37.4 kg d-1 with RSC versus 37.0, 31.5, and 36.0 kg d-1, respectively, during the control periods. For the other sites, RSC did not significantly increase milk production; milk yield with RSC was numerically higher than for controls at 2 of the 3 sites. Supplementing transition dairy cows with RSC can significantly improve performance in early lactation.

Key Words: Choline, transition cow, milk yield

997   Production response of lactating ewes to increasing dosage of recombinant bovine somatotropin. D. K. Aaron*, D. G. Ely, W. P. Deweese, E. Fink, and B. T. Burden, *University of Kentucky, Lexington.*

Production response to increasing dosage of recombinant bovine somatotropin (bST, Sometribove) was measured on 24, multiparous, spring-lambing Polypay ewes (70 kg), each nursing twin lambs during a 63-d experiment. The lactation diet contained 63% roughage and 37% concentrate. Ewes were fed at 0800 and 1600 so daily intake equaled 5.2% BW. Lambs, separated from ewes, were allowed ad libitum access to a creep diet during the same times. Ewes and lambs were individually weighed and ewes were condition-scored and machine-milked every 7 d beginning on d 12 of lactation. Ewes received s. c. injections of either an oil placebo (0 mg bST; n = 8), 160 mg bST (n = 8), or 240 mg bST (n = 8) on d 26, 40, and 54. As bST dosage increased, estimated 24-h milk production increased in linear fashion on d 33 (2431, 3170, and 2997 g; P < 0.01), d 40 (2204, 2603, and 2562 g; P < 0.10), d 47 (2352, 2826, and 2736 g; P < 0.05), and d 61 (2043, 2435, and 2365 g; P < 0.04). In contrast, milk production response was quadratic (P < 0.10) on d 54 and 68 with highest yields at 160 mg. Milk production efficiency and milk DM and fat contents followed similar patterns. Neither mastitis incidence nor milk somatic cell count was affected by bST treatment. Ewes in all three groups tended to gain weight and condition, but no significant differences were found. Beginning on d 40 and continuing through weaning on d 68, twin lamb weights increased linearly (P < 0.06) as ewe bST dosage increased. Also, creep feed intakes tended to be higher for

lamb pairs nursing bST-treated ewes. Over the entire collection period, ewes receiving 0, 160, and 240 mg bST produced 130.5, 152.9, and 147.8 kg total milk (linear, P < 0.05), had milk production efficiencies of .62, .69, and .70 (linear, P < 0.03), and had lamb production efficiencies of .16, .17, and .18 (linear, P < 0.08). Lamb pairs nursing ewes treated with 0, 160, and 240 mg bST had total gains of 37.3, 41.2, and 43.1 kg (linear, P < 0.02) and 60-d adjusted weaning weights of 50.0, 54.9, and 54.5 kg (linear, P < 0.07).

Key Words: Ewes, Somatotropin, Lactation

998   Phosphorus characteristics in swine manure fed with control vs. phytase treated diets. Z. Dou*, R. Allshouse, P. Pitcher, J. Toth, D. Galligan, J. Ferguson, and C. Ramberg, *University of Pennsylvania, Kennett Square.*

Manipulating animal diet formulation to improve nutrient utilization efficiency while reducing nutrient excretion in manure is a valuable tool in animal agriculture nutrient management. Phytase is an enzyme that can increase the bioavailability of P in corn and soybean meals for pigs and chickens and thus replace some of the inorganic P supplementation, hence reducing manure P excretion. We conducted a feeding trial to investigate the impact of phytase feeding on the forms and fraction distributions of P in pig manure. The experimental design was a 2 x 2 latin square, replicated eight times, with eight growing pigs blocked on weight and randomly assigned to a control diet or a phytase treated diet. Both diets were formulated according to NRC recommendations for growing pigs. The actual feeds, prepared by a local feed company and fed to the experimental pigs, contained 0.69% total P for the control and 0.66% total P for the phytase treated diet, respectively, with 0.33% available P for both diets. Manure was collected and samples taken for total P and fractionation analyses. Total P in manure was reduced from 15.64 mg/g in the control to 13.33 mg/g in the treated samples (P=0.02). The amounts of P (mg/g) released through a sequential extraction from manure of control vs. treatment are: 9.27 vs. 7.83 (P=0.06) in water, 3.37 vs. 2.98 (P=0.02) in NaHCO3, 0.23 vs. 0.14 (P=0.01) in NaOH, and 2.77 vs. 2.38 (P=0.27) in HCl solutions, respectively. However, the relative fraction distributions, expressed as the percentage of total P extracted by each solution, did not differ for control vs. treated samples. Nevertheless, the P fraction extracted by a single extraction of water for 1-hr averaged 19.3% for the treated samples, comparing to 22.0% for the control (P=0.15), suggesting the tendency of reduced most vulnerable P fraction with the phytase treatment.

Key Words: Phytase, Manure, Phosphorus

999   Fender design and insulation effects of farrowing huts on productivity of outdoor sows and piglets. A. K. Johnson*[1], J. L. Morrow-Tesch[2], and J. J. McGlone[1], [1]*Pork Industry Institute, Texas Tech University, Lubbock,* [2]*USDA-ARS, Lubbock, TX.*

Two hundred and six lactating sows and their litters were used to determine the effects of two fender designs (metal vs. wood) and insulation vs. non-insulation inside farrowing huts on the productivity of sows and their litters. All sows were PIC genetic stock, of contemporary age, and fed a completely balanced milo-soy diet. Ambient temperature and relative humidity were recorded every 15 minutes inside eight farrowing huts (four insulated and four non-insulated) from August to November 1999. Litter weight at weaning was heavier (P < .05) in metal fender huts than in wooden fender huts (7.8 ± 0.4 and 7.4 ± 0.4 kg). However, neither fender design nor insulation of the farrowing huts affected piglet mortality (17.0 ± 4.2 and 18.0 ± 3.8 %), sow starting weight (259.0 ± 9.5 and 258.7 ± 8.0 kg), or ending weight (240.16 ± 9.4 and 238.7 ± 8.0 kg). Month affected average litter birth weight (P < .01), piglet mortality (P < .01), number of pigs weaned per litter (P < .01), average litter wean weight (P < .01), sow starting weight (P < .01) and ending weight (P < .01). Ambient temperature and relative humidity were lower (P < .01) inside the insulated vs. non-insulated farrowing huts. In conclusion, sows in huts with metal fenders weaned a heavier litter than sows in huts with wooden fenders. Insulating the farrowing hut did not have any effect on production. Mortality of piglets decreased and litter weaning weight increased from August to November. Month affected post weaning sow weights with a loss in September and November but a gain in October. Insulating farrowing huts kept the inside of the farrowing hut cooler but did not affect production parameters. The

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use of tall fenders attached to farrowing huts gained some production benefits.

Key Words: Production, Fender Design, Insulation

1000   Effects of stocking rate and diet on ground cover, soil-nitrate and sow performance in a sustainable production system. H. A. Rachuonyo*[1], V. G. Allen[1], W. G. Pond[2], and J. J. McGlone[1], [1] *Texas Tech University, Lubbock,* [2] *Cornell University, Ithaca, NY.*

Gestating sows (n=126) were randomly assigned to .4-ha paddocks in an outdoor swine production system at a stocking density of 17.3 or 34.6 sows/ha. Sows were fed a conventional diet or one with high levels of lysine. The experiment was conducted over two parities with three replicates each. Each paddock was sub-divided for sampling into 3 sections: 1) near the radial center, 2) the middle region and 3) an outer section. Soil samples (15 cm deep) were taken at the start and at the end of the study from 3 points in each section and were assayed for nitrate-nitrogen (N). Percent ground cover was visually estimated at the start of the trial and every 30 d thereafter until the end of the study. Sow weights were taken at the time of assignment to treatments, when they were moved to farrowing pastures, and at weaning time. Production data included total number of pigs born per sow, number born alive or dead, birth weight, male:female ratio, number weaned, average weaning weights, and mortality. Nitrates were analyzed as a split-plot over time. Performance data were analyzed as a completely randomized design. There was no difference (P > .05) in soil N due to either stocking rate or diet. However, ground cover was reduced (P < .01) by the higher stocking rate (34.6 sows/ha) at a rate of 14% every 30 d compared with a rate of 5% by the lower stocking rate (17.3 sows/ha). More (P < .01) piglets were weaned per sow (8.4 vs 7.1 $\pm$ .34) from the higher stocking rate. Piglet mortality was higher (P < .05) for the lower stocking rate (25.7 vs 18.1 $\pm$ 2.2). This study indicated that a stocking rate of 34.6 vs 17.3 sows/ha may have increased production potential but longer-term studies are needed to determine effects on forage and nutrient management.

Key Words: Pig, Diet, Environment

1001   Use of Lutalyse to facilitate the training of boars for semen collection. M.J. Estienne and A.F. Harper*, *Virginia Polytechnic Institute and State University, Blacksburg.*

The objective was to determine the effects of prostaglandin-F2alpha (Lutalyse; Pharmacia & Upjohn Company, Kalamazoo, MI) on the training of sexually active boars (i.e., boars experienced with natural mating) to mount an artificial sow for semen collection. Fourteen boars (4 Hampshire, 4 Landrace and 6 Yorkshire) ranging in age from 1 to 4 years were utilized, and treatment groups were balanced for breed and age. Boars were moved to a semen collection pen twice weekly for 4 wk, and training sessions for each boar lasted a maximum of 15 min. Upon entering the collection pen, 7 boars received an i.m. injection of 10 mg Lutalyse and seven control boars received an i.m. injection of 2 ml deionized water. Boars were considered trained when after a successful collection, the animals mounted the artificial sow and allowed semen collection on the next scheduled day without first receiving an injection of Lutalyse or deionized water. Six of 7 Lutalyse-injected boars and 2 of 7 control boars mounted and allowed semen collection during the first exposure to the artificial sow (P < .03). After 4 training sessions, 7 of 7 Lutalyse-treated boars and 4 of 7 controls were successfully trained (P < .05). At the conclusion of the eighth training session, 3 remaining untrained controls were administered Lutalyse and 2 of the boars mounted the artificial sow and allowed semen collection. Reaction time (interval from entering collection pen to start of ejaculation; 476.2$\pm$52.9 s), duration of ejaculation (267.5$\pm$24.6 s), semen volume (163.7$\pm$12.1 mL), sperm concentration (385.6$\pm$28.8 million/mL), and total sperm cells (58.0$\pm$.5 billion) were similar (P >.1) for boars receiving injections of Lutalyse or deionized water and for trained boars receiving no injections. The number of false mounts (mounting artificial sow but not allowing semen collection) was affected (P < .06) by treatment and was 1.6 $\pm$.5, 4.0$\pm$.9, and 4.2$\pm$1.0 for Lutalyse- and deionized water-injected boars, and trained boars receiving no injections, respectively. In conclusion, use of Lutalyse has potential for expediting the training of sexually active boars to mount an artificial sow for semen collection.

Key Words: Prostaglandin, Libido, boar

1002   Developing a method for testing breeding products using data from commercial pig farms. J.W.G.M. Swinkels*[1], G.W.J. Giesen[2], J.W. van Riel[1], and G.B.C. Backus[1], [1] *Research Institute for Pig Husbandry, Rosmalen, The Netherlands,* [2] *Wageningen Agricultural University, The Netherlands.*

A total of 438 sow farms and 101 growing-finishing pig farms were used to develop a method for testing of breeding products using data from management information systems (MIS). A breeding product is defined as a combination of one sow- and one boar-line marketed by one breeding company. As part of the quality control of the MIS-data, all pig records were checked. If a single error was found, the entire farm was excluded. Moreover, only farms were used that had a population consisting of 90% or more of one breeding product. On each farm a survey was conducted. Using the survey, over 100 variables were computed to characterize the farm and farmer. From the MIS, 17 and 13 index figures were computed for each sow and growing-finishing pig farm, respectively. For the statistical analyses, 125 sow farms with six different breeding products and 60 growing-finishing pig farms with four different breeding products were used. The minimum number of sow and growing-finishing pig farms per breeding product was 16 and 10, respectively. In sow farms, the overall farm average of the piglets born alive was 10.9+.47 (mean$\pm$sd). Corrected for "farm size", "region", "feed company" and some aspects of farmer and management, the maximum difference among the six breeding products was .72 piglets per litter (P<.01). Of the 17 index figures, nine were influenced (P<.05) by breeding product. In growing-finishing pig farms, the overall farm average of lean meat was 55.4+.43% (mean$\pm$sd). The maximum (corrected) difference among four breeding products was .7% (P<.01). The index figures "type AA+A" and "slaughter weight" were similar for the four breeding products. The other 10 index figures were not analyzed due to the small number of farms per breeding product. In conclusion, a test of pig breeding products can be performed using MIS-data from commercial sow farms. For growing-finishing pigs, the number of farms per breeding product was too low to analyze all index figures.

Key Words: pig breeds, performance testing, farm comparisons

1003   Effect of modifications to pen design formation on the performance of weaned pigs housed in large group systems. P.C. Penny*, *JSR Healthbred Ltd, Southburn, UK.*

Conventional methods of penning weaned pigs is being overshadowed by the implementation of larger group systems. The objective of this experiment was to determine the effect of pen design modifications on large group pig performance during the first five weeks post weaning. A total of 1170 weaned pigs (JSR Genepacker 90) were used in a randomised block design involving three treatments with 130 pigs per group. Pen design treatments related to control (C) 0.22 m $^{(}$2) d 0-35, Design 1 (D1) 0.22 m $^{(}$2) d 0-28 and 0.30 m $^{(}$2) d 29-35 with feeder allocation in two locations, Design 2 (D2) 0.12 m $^{(}$2) d 0-7, 0.22 m $^{(}$2) d 8-28 and 0.30 m $^{(}$2) d 29-35 with feeder location as C. Feeder allocation was 50 mm/pig and a feeding programme was standardised for all treatments. Pigs were weighed individually at weaning, d 7, 14, 21, 28 and 35. Age at weaning 26 (s.e. 0.08) days, live weight 7.6 (s.e. 0.03) kg. D1 had a significantly higher (P<.01) average daily gain (ADG) from d 0-7 (0.188 vs 0.149 vs 0.156 kg) compared to C and D2. Gain / feed (G / F) was improved (P<.05) for D1 and D2 during d 0-7 (0.99 vs 0.86 vs 0.78). From d 22-28 D1 achieved a higher ADG (P<.05) compared to C and D2. Both D1 and D2 produced a large ADG increase (P<.001) between d 28-35 (0.632 vs 0.627 vs 0.552 kg) compared to C. Overall d 0-35, D1 and D2 exhibited a significantly higher (P<.05) ADG (0.430 vs 0.418 vs 0.405 kg) and G/F benefit (0.77 vs 0.75 vs 0.71). These results suggest that provision of two feeding locations within a large group system can deliver increased growth opportunities. Improving intra-space distance between pigs during the latter stages of growth provides unrestricted movement, this could be a necessary component for large group functionality.

Key Words: Pigs, Pen Design, Performance

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1004   Effect of adjustments to feeding space allocation on pigs provided with a reduced floor space allowance. P.C. Penny* and P.J. Penny, *JSR Healthbred Ltd, Southburn, UK.*

It is clear that a reduction of floor space, usually obtained by increasing pig numbers per pen decreases pig growth, although often other important pen resources such as feeding space are unadjusted. It is hypothesised that by reducing floor space allowance whilst at the same time increasing feeding opportunity will counteract this negative effect and optimise pig performance, the objective of this experiment was to test this hypothesis. A total of three hundred and ninety six (JSR Genepacker 90) grower pigs were used in a randomised block design involving three treatments and six replicates providing 22 pigs per pen. Standard (ST) 0.4 m $^{(2)}$ + 50 mm of feeding space / pig, Minimum (M) 0.3 m $^{(2)}$ + 50 mm and Minimum+ (M+) 0.30 m $^{(2)}$ + 100 mm. Mean start weight of 21.3 (s.e. .11) kg, pigs were weighed on d 14 and 28. All pen dimensions, proportions and design layout were standardised and the experimental period was 28 days. Eleven pigs failed to finish the experiment, these were divided four, five and two between ST, M and M+ respectively. Average daily feed intake (ADFI) d 0-14 was higher (P<.05) for ST than M. Between d 15-28 ST and M+ exhibited an increased (P<.05) average daily gain (ADG) compared to M (0.719, 0.713 vs 0.676 kg), ADFI was also higher for ST (P<.001) and M+ (P<.05) during this growth period (1.395, 1.360 vs 1.287 kg). From d 0-28 ADG was higher (P<.01) for ST than M, but not M+. ADFI from d 0-28 was greater for ST (P<.001) and M+ (P<.05) compared to M (1.149, 1.110 vs 1.075 kg). The coefficient of variation for ADG from d 15-28 and d 0-28 for ST, M and M+ was .23, .24, .19 and .17, .22 and .17 respectively, indicating reduced variation for M+. In conclusion these results confirm that a combination of low floor space allowance and feeding provision, causes a detrimental response to pig growth and feed intake. However, supplementing a reduced floor space allowance with increased feeding opportunities overturns this negative response and can deliver major performance benefits.

Key Words: Pigs, Feeding Space, Performance

1005   Effectiveness of obtaining gilts differing in body composition at farrowing. P.C. Penny*[1] and H.M. Miller[2], [1]*JSR Healthbred Ltd, Southburn, UK,* [2]*University of Leeds, School of Biology, Leeds, UK.*

The aim of this study was to determine whether gilts of the same genotype which are inherently lean or fat at service would remain so through gestation. These gilts could then be used to investigate effects of body type during lactation without utilizing dietary manipulation in gestation and therefore avoid any resultant confounding effects. Three hundred high lean potential gilts (JSR Healthbred) were fed ad libitum from weaning to service. At service and farrowing gilts were weighed and P2 backfat measured 65 mm from the midline over the last rib. From service to farrowing all gilts received 2.5 kg/gilt/d from d 21-90, 3.25 kg/gilt/d from d90 to farrowing. The diet contained 16.0 % CP, .8 % lysine and 3.25 Mcal/kg. At service gilts which had a P2 ≤ 15 mm were classed as lean (Ls) and gilts with a P2 >15 mm were classed as fat (Fs). At farrowing gilts with a P2 =20 mm = Lf and those with P2 >20 mm = Ff. There was no difference in age between Ls (n=149) and Fs (n=151) gilts. Ls gilts were on average 11.8 kg lighter and 7 mm leaner (P<.001) compared to Fs gilts (149.5 vs 161.3 kg and 12.5 vs 19.5 mm). At farrowing 296 of the original 300 gilts remained. From the Ls gilts 63 % continued within the same body type until farrowing, with 36 % of Ls gilts transferring to Ff status. This compared to 98 % for Fs gilts retaining the same body type. At farrowing Lf (n=94) gilts were again both lighter 16.3 kg BW and leaner 9.7 mm (P<.001) than Ff (n=202) gilts. These results suggest that it is possible to select gilts at service on the basis of body type for subsequent experimentation during lactation. However, one third of gilts which achieved lean body composition status at service, changed and became fat at farrowing. This methodology of obtaining gilts of specific body type at farrowing therefore questions the unknown effects that extreme dietary manipulation during gestation could have on lactation and metabolic response.

Key Words: Gilt, Body Composition, Farrowing

1006   Effect of zinc oxide inclusion level on diet selection of weaned pigs. P.C. Penny*[1] and S. Tibble[2], [1]*JSR Healthbred Ltd, Southburn, UK,* [2]*SCA Iberica S.A. Mequinenza, Espana.*

The objective of this study was to investigate the effect of zinc oxide inclusion on the diet selection of pigs post weaning. A total of two hundred and sixty pigs were randomly allotted to one of two experimental treatments. Each treatment utilised four distinct diets A,B,C and D each differing only in nutrient density concentration. These were provided on a choice basis feeding programme as follows, diet A / B from d 0-7, B / C from d 8-14 and C / D from d 15-21 and d 22-28. Zinc 1 (Z1) equated to 3.0 kg of zinc oxide inclusion for diets A+B+C and 0 kg in diet D, Zinc 2 (Z2) had 3.0 kg in diets A+B, 1.5 kg for diet C and 0 kg diet D. From d 0-7 preference for diet A was substantially above that of diet B, 78 vs 22 and 86 vs 14 % for Z1 and Z2 respectively. During d 8-14 pigs on Z1 consumed 57 % of diet B in favour of C, for Z2 the quantity of diet B intake was distinctively lower (P<.01) at 35 % with the remaining 65 % of intake being attributed to the lower density diet C. Diet selection altered for Z1 from d 15-21 with a shift away from diet C opting instead for the lower density diet D, 38 vs 62 %. Z2 continued with the adoption of consuming diet C compared to D, but the movement for Z2 was less distinct 42 vs 58 % than that expressed by Z1. Intake distribution of diets C and D from d 22-28 for Z1 delivered a major reduction of diet C consumption (P<.01) towards a strong preference for diet D, 17 vs 83 % this compared to the transition response of pigs within Z2 treatment 32 vs 68 %. These results demonstrate that when pigs are provided with opportunities of diet selection, careful consideration should be given to zinc oxide inclusion levels within the diets presented.

Key Words: Pigs, Zinc Oxide, Diet Selection

1007   The Growth Performance of the Progeny of Two Sire Lines Reared under Differing Environmental Conditions. D. N. Hamilton*[1], M. Ellis[1], B. F. Wolter[1], N. R. Augspurger[1], F. K. McKeith[1], and E. R. Wilson[2], [1]*University of Illinois, Urbana,* [2]*PIC, Franklin, KY.*

A total of 340 pigs were used in a 2×4×2 factorial arrangement to investigate the effects of and interactions between sire line, rearing environment, and sex on growth performance from 40ñ1.5 to 120ñ2.5 kg live weight. Sires from line A (n=8) and line B (n=9) were mated to PIC C22 dams. Line A was of Pietrain ancestry and line B was a synthetic line containing Large White, Landrace, Duroc and Pietrain. Pigs reared in the I environment were kept in individual pens (1.58 m^2 /pig) and fed an antibiotic at a therapeutic level during the first two weeks of the study. The S environment consisted of groups of 4 pigs with a more than adequate floor space allowance (.93 m^2/pig). Pigs grown in the F (FIRE system) environment were housed in groups of 8 with an adequate floor space allowance (.90 m^2/pig). C pigs were kept in groups of 12 pigs with a reduced floor space allowance (.37 and .56 m^2/pig for the grower and finisher phases, resp.). There were no interactions (P > .05) between sire line and rearing environment for growth performance. Progeny of line A compared to line B pigs grew slower (983 vs. 1044 kg/d, SE=13.4, P<.05), had similar feed intake but a higher gain:feed ratio (.36 vs. .38, SE=.005, P<.05). Pigs reared in environment I grew the fastest and C pigs grew the slowest while F and S pigs were similar (1156 vs. 1019 vs. 981 vs. 898 g/d, SE=18.7, P<.05, for I, F, S and C, resp.). Environment I pigs had the highest feed intake and F and C pigs had the lowest while S pigs were intermediate (3061 vs. 2497 vs. 2813 vs. 2627, g/d, SE=51.5, P<.05, resp.). Animals reared in the F environment had the highest gain:feed while S and C pigs had the lowest (.38 vs. .41 vs. .35 vs. .34, SE=.007, P<.05, for I, F, S and C). Differences between sexes for growth traits were in agreement with previous research. This study suggests that the relative difference in growth performance between these two sire lines was similar across the wide range of environments evaluated.

Key Words: Sire Line, Environment, Growth

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1008 The Meat Quality Characteristics of the Progeny of Two Sire Lines Reared under Differing Environmental Conditions. D. N. Hamilton*[1], M. Ellis[1], B. F. Wolter[1], F. K. McKeith[1], and E. R. Wilson[2], [1]*University of Illinois, Urbana,* [2]*PIC, Franklin, KY.*

A total of 128 pigs (120 kg) were used in a $2 \times 2 \times 2$ factorial arrangement to investigate the effects of and interactions between sire line (A vs. B), environment (spacious vs. crowded), and sex (barrow vs. gilt) on meat quality characteristics. Sires from line A (n=7) and line B (n=8) were mated to PIC C22 dams. Line A was of Pietrain ancestry and line B was a synthetic line containing Large White, Landrace, Duroc and Pietrain. All male and female parents were from lines that had been tested as free of the detrimental allele of both the Halothane and RN genes. Pigs in the spacious environment (S) were kept in groups of 4 animals with a more than adequate floor-space allowance (.93 m^2/pig). Pigs in the crowded environment (C) were kept in larger groups of 12 pigs and with a reduced floor-space allowance (.37 and .56 m^2/pig for the grower and finisher phases, resp.). Line A compared to line B pigs had poorer longissimus meat quality, having lower ultimate pH (5.43 vs. 5.48, SE=.018, P<.05), subjective color scores (2.0 vs. 2.5, SE=.11, P<.05), subjective firmness (2.0 vs. 2.4, SE=.12, P<.05) subjective marbling (1.9 vs. 2.3. SE=.13, P<.05), indicating paler, softer meat with less marbling, and higher L* (49.37 vs. 47.42, SE=.647, P<.05). Animals reared in the C compared to the S environment had lower longissimus L* values indicating darker muscle (47.17 vs. 49.61, SE=.643, P<.05). A genotype × environment interaction was found for drip loss. Line B pigs had lower drip loss in the C compared to the S environment (4.46 vs. 6.69 %, resp., SE=.616, P<.05); there was little difference for drip loss in the two environments (6.96 vs. 7.29 %, resp., SE=.616, P<.05). This study highlights the effect of genotype on meat quality but shows that the two environments used had limited impact on pork quality.

Key Words: Sire Line, Environment, Meat Quality

1009 Effect of sprit-weaning on sow and piglet performance. G. E. Bressenr*, S. W. Kim, and R. A. Easter, *University of Illinois, Urbana.*

Twenty-eight primiparous sows and litters were used to study the effect of split-weaning on sow and piglet performance. Sows were fed ad libitum during the 21 d lactation and litter size was set to 10 pigs by cross-fostering as needed within 48 h of farrowing. Feed intake of sows and body weights of sows and nursing pigs were recorded weekly. Backfat thickness (10th rib) of sows was recorded on d 109 of gestation and d 21 of lactation. Sows were separated into two groups of fourteen sows. Litters from the first group of fourteen sows (control) were weaned on d 21 of lactation. On d 14, the five heaviest (H) pigs (avg 4.34 kg body weight) from each sow in the second group (split-weaned) were weaned leaving the five lightest (L) (avg 3.46 kg body weight) to suckle for an additional 7 d. Conventional and split-weaned sows had similar body weights at d 1, 7, and 14, but the sows from the sprit-weaned group were heavier (P < .05) at d 21 of lactation. Total body weight loss during d 1 to 21 of lactation was greater for control sows (P < .07) than split-weaned sows. The back fat loss was greater (P < .1) in control sows (2.13 mm) than in split-weaned sows (.45 mm) during 21-d lactation. Average daily gains of heavy piglets (220 g) from split-weaned litters were greater (P<.05) than those pigs (196 g) left on the sow for the entire lactation period. More importantly light pigs exhibited similar (P > .07) average daily gains (187 g), when compared to heavy pigs (196 g) left on the sow for the whole lactation period. This study suggests that split-weaning will reduce sow body weight loss while maximizing total litter performance.

Key Words: Sows, Split-weaning, Litter growth

1010 Effects of a polyaspartate biopolymer (PAB) on growth performance of weanling pigs. A.F. Harper* and M.J. Estienne, *Virginia Polytechnic Institute and State University, Blacksburg.*

The potential for development of resistant microbes and regulatory concerns may force reduced use of antibacterial feed additives and increases the need for non-antibacterial growth promoters. The objective of this experiment was to determine the effects of dietary inclusion of PAB (Donlar DXL590; Donlar Life Sciences, Bedford Park, IL) on the performance of nursery pigs. Crossbred pigs (Yorkshire x Landrace and Yorkshire x Landrace x Hampshire), 17 to 24 d of age and 7.7 kg BW, were weaned and assigned to one of four dietary treatments which included PAB inclusion rates of 0 (control), 100, 200, or 400 ppm. There were 6 replicate pens of 4 pigs each per treatment (96 pigs total; 24 pigs per treatment). Diet nutrient density was adjusted in 3 phases to meet NRC (1998) requirements over the 5-wk trial and feed and water were available ad libitum. Pig BW and pen feed consumption were determined weekly. There were no effects (P > .1) of PAB on any measure of pig performance at any point during the experiment. For the entire trial, growth rate (kg/d), feed consumption (kg/d) and feed conversion efficiency (feed/gain), were similar (P > .1) for controls (.50±.02, .83±.04, and 1.65±.05, respectively) and pigs receiving 100 ppm (.50±.01, .84±.04, and 1.70±.05, respectively), 200 ppm (.49±.01, .83±.02, and 1.68±.04, respectively), or 400 ppm (.51±.02, .87±.04, and 1.70±.05, respectively) PAB. Weekly stool evaluations (1 to 5; 1 = very firm feces and 5 = very loose, watery feces) were conducted to assess the incidence and severity of scouring. Overall fecal scores were similar (P > .1) between groups and for the entire five week trial were 3.1±.09, 3.2±.1, 3.1±.08, and 3.1±.1 for controls, and pigs receiving 100, 200 or 400 ppm PAB, respectively. Under the conditions of this experiment, there were no effects of the Donlar DXL590 polyaspartate biopolymer on performance of nursery pigs.

Key Words: Growth Performance, Polyaspartate Biopolymer, Pigs

1011 Effects of Acclimate on the incidence of aggression and growth performance in weaned pigs. M. Amstutz*, K. Bennett-Wimbush, T. Meek, and S. Courtney, *The Ohio State University Agricultural Technical Institute, Wooster.*

Newly weaned pigs often exhibit aggressive behavior which can result in injury, reduced performance, and in severe instances death. This experiment was designed to determine the effect of Acclimate (Exodus Breeders Supply, Ltd., York, PA.), a product reported to reduce equine aggression, on weaned pig aggression and growth performance. Eighty-two weaned pigs (avg. wt. 6.25 kg) were blocked by sex, weight, and litter and randomly assigned to either an Acclimate treatment or control group. Groups consisted of 11-12 pigs each and were housed on 4 x 8' raised nursery decks. Pigs in the treatment group were marked with Acclimate on the nose, face, and neck at weaning. All pigs were uniquely identified and videotaped for two hours post weaning. The incidence of aggression (IOA) was determined on an individual pig basis for the two hour period following weaning. Individual pig weights and pen feed consumption were used to determine feed intake (FI), total weight gain (TWG), average daily gain (ADG), and gain to feed ratio (G/F) over a seven day period. Differences between litter, sex, and treatment for IOA and TWG were tested using GLM, SAS at a p < 0.05 significance level. Neither Acclimate treatment of weaned pigs nor sex had a significant effect on IOA or TWG. However, there was a trend toward decreased IOA with Acclimate treated pigs (LS mean: control 4.9 ñ 0.8, Acclimate 3.5 ñ 0.8) which seemed to be accompanied by a decrease in the intensity of aggression. It should be noted that considerable variability in the IOA was observed between individual pigs and between replicates. TWG for the seven day period was 1.20 and 1.29 kg for control and Acclimate treated pigs respectively. Pig litter did effect IOA and TWG (p < 0.001). These preliminary results suggest that Acclimate treatment of weaned pigs does not decrease the IOA, but may decrease the intensity of aggression without negatively effecting growth.

Key Words: Pig, Aggression, Behavior

1012 The feed intake behavior of the progeny of two sire lines monitored by a computerized feed intake recording system. N. R. Augspurger*[1], M. Ellis[1], D. N. Hamilton[1], B. F. Wolter[1], J. L. Beverly[1], and E. R. Wilson[2], [1]*University of Illinois, Urbana-Champaign,* [2]*PIC, USA, Franklin, KY.*

Forty-eight pigs were used in a completely randomized design with a 2×2 factorial arrangement of treatments to investigate the effect of sire line and sex on feed intake behavior of growing-finishing pigs. Sire line A was of Pietrain ancestry and sire line B was a synthetic line comprised of Large White, Landrace, Duroc, and Pietrain. Sires from Line A (n=8) and Line B (n=9) were mated with PIC Camborough 22 females. Growth performance and feed intake behavior of the progeny were measured from 40.2ñ2.04 kg to 120.0ñ2.85 kg BW. Pigs were housed in groups of eight with two pigs from each each line × sex subclass. The floor space allowance was .9 m^2/pig. Feed intake behavior was

monitored by a computerized feed intake recording system (F.I.R.E., Osborne, KS). Pigs were allowed a one-week acclimation period prior to the start of the study. Line B progeny grew faster (1042 vs 960 g/d, SE=18.4, P<.01), had a higher daily feed intake (2604 vs 2432 g/d, SE=51.7, P<.05), but a similar gain to feed ratio compared to the progeny of line A.. Line B pigs tended to visit the feeder less often (13.4 vs 15.5, SE=.81, P<.10), but consumed more feed per visit (213 vs 177 g, SE=10.2, P<.05), and had a faster consumption rate (36.8 vs 29.8 g/min, SE=2.02, P<.05) than Line A pigs. There were no differences between the two lines for feeder occupation time per visit or per day. Castrates grew faster (P<.01), consumed more feed (P<.001), and were less efficient (P<.01) than gilts, but there were no differences between the sexes for any of the feed intake traits. Feed intake behavior showed significant changes with increasing pig live weight between the live weight ranges 40 to 80 kg and 80 to 120 kg: number of feeder visits and feeder occupation time per visit and per day decreased, and feed intake per visit and feed consumption rate increased with increasing pig live weight. The results of this study illustrate the influence of genetics and, particularly, live weight on feeding behavior in growing-finishing pigs.

Key Words: Sire Line, Sex, Feed Intake Pattern

1013   Effect of oil spraying on dust reduction and on subsequent pig performance. B. K. Anderson*, X. Wang, M. Ellis, and G. Riskowski, *University of Illinois, Urbana.*

In a series of five 28 day trials, a total of 688 finishing pigs with an average starting weight of 77.31 ± 1.15 kg were used to determine the efficacy of oil spraying as a measure of dust reduction and to evaluate the subsequent pig performance. Pigs were blocked by weight and allotted to treatment by sex and ancestry. Pigs were housed in identical rooms within industry similar facilities at a stocking density of .95 m^2/pig. Pigs were housed in two buildings on the Moorman Swine Research Farm at the University of Illinois. Pigs were offered ad libitum access to stock diets for the entire four week experimental period. Diets were formulated to meet or exceed NRC (1998) requirements. Soybean oil was applied daily to the pen surfaces through use of a hand-held applicator. The applicator was calibrated to dispense exact levels of oil. The oil was applied to the surface of both the pen and pigs, attention was taken to not spray the fencing or feeders. Oil was applied daily between the hours of 0800 and 1000. The oil was applied in a predetermined schedule where days 1-2 received 40 ml/m^2, days 3-4 received 20 ml/m^2, and days 5-28 received 15 ml/m^2. Pigs were weighed and feed disappearance was recorded every two weeks for the determination of average daily gain and feed efficiency. Dust mass samples were taken weekly by drawing air through a 37 mm diameter Millipore filter (0.8 um pore size) for 24 h in the center of the alley at a height of 5 ft. Filters were dried in a dessicant drier for 24 h, then weighed on a precision electronic balance prior to and following sampling for determination of dust mass. Dust mass concentration was reduced by an average of 57% across the five trials with a maximum and minimum reduction of 64 and 47% respectively. Oil spraying did not have an effect on average daily gain, feed intake or gain:feed. Therefore, results of this study indicate that oil spraying is effective in reducing dust without affecting animal performance.

Key Words: Pigs, Dust, Performance

1014   Effect of varying the amount of potato chip scraps in the diet of pigs at different stages of growth on their performance. S. Rahnema* and R. Borton, *Ohio State University, Agricultural Tecnical Institute, Wooster.*

An experiment was conducted to determine the effect of changing the amount of potato chip scraps (PCS) at different stages of growth on dry matter intake (DMI), total gain (TG), average daily gain (ADG), and gain to feed ratio (G:F) of swine. Pigs (n = 176, avg wt 8.63±.15 kg) were stratified by sex and weight and used in a randomized complete block design experiment with four treatments in four blocks. Each treatment consisted of four pens of 10 or 12 pigs each. In treatment one (control), pigs were fed a corn and soybean meal-based diet supplemented to meet NRC requirements. In treatments two, three, and four, 10%, 12.5%, and 20% of the corn, respectively, was replaced with 10%, 12.5%, and 20% of PCS. The level of PCS in the control (none) and 12.5% PCS diets was kept unchanged throughout the experiment. However, the level of PCS in the 10% diet was increased to 15 and then

20% and the 20% PCS diet was lowered to 15 and then 10% at the growing and finishing stages, respectively. Changing the levels of PCS during different stages of growth had no effect on TG (P = .77) or the G:F (P = .23). However, DMI tended to be lower (P<.09) for pigs on the 12.5% PCS vs the control and 20% PCS diets. Also, the ADG for pigs that were initially started on the 20% PCS diet was lower (P = .01) than the other three treatments. The number of days needed to reach market weight were 128, 133, 128, and 143 for pigs on the control, 10, 12.5 and 20% PCS diets, respectively. Of the carcass characteristics and organoleptic factors studied in this experiment, only juiciness and overall ratings for chops from pigs on the 12.5% PCS diet were rated lower than the control and 10% PCS. This experiment demonstrates that there was no advantage in increasing or decreasing the level of PCS at different stages of growth over the control or continuous feeding of 12.5% PCS in the diet of pigs.

Key Words: Potato Chips, Pig Performance, Carcass Characteristics

1015   Effect of chromium methionine supplementation on egg hatching response of Japanese quail under controlled temperature condition in dry tropic weather. G. Contreras*, R. Barajas, and A. Montoya, *Universidad Autonoma de Sinaloa.*

To determine the effect of chromium methionine supplementation, on hatching egg production response of Japanese quail under weather controlled condition (25°C) in dry tropic, one all randomized design experiment was conduced, 320 Japanese quail (240 females and 80 males) were divided in 40 groups of eight avian (six females and two males), each group of eight quails was allocated in a metal wire crate (25 x 30 cm), including as part of a battery of crates with five levels and four crates by levels (20 crates), each battery level (32 quails) was considered as an observation, and were randomly assigned to consume one of two experimental diets in that consist the treatments: 1)Diet containing 21% CP and 2.9 Mcal ME/kg (control); and 2) Diet similar to control, supplemented with 200 ppb of Cr from chromium methionine (Met-Cr). Chromium methionine supplementation, increased (P<0.01)in 32.8% the average daily egg production (64.14 vs 87.85%) and percent of egg production (55.12 vs 73.21%). Met-Cr improved (P<0.01) in 56.3% the average of daily hatching egg production (39.4 vs 61.6), and in 17.7% the percent of hatching egg (59.7 vs 70.1%). Daily feed intake was aumented (P<0.01)in 8.3% by Met-Cr supplementation (5.32 vs 5.76 g/d). The long, wide, and weight of eggs were not effected by treatments. The index feed intake/egg production was diminished in 11.1% by Met-Cr treatment (0.648 vs 0.576). It is concluded, that chromium methionine supplementation improve the production of egg and hatching egg in Japanese quail under weather controlled condition in dray tropic areas.

Key Words: Chromium, Japanese quail, Hatching

1016   Effect of supplementation in drinking water with two organic chromium sources on blood glucose level and weight gain of Japanese quail (Coturnix coturnix japonica) in their first week of live. G. Contreras*, N. Montesinos, and R. Barajas, *Universidad Autonoma de Sinaloa.*

To determinate the effect of supplementation in drinking water of chromium picolinate (Pic-Cr) or chromium methionine (Met-Cr) on blood glucose level and weight gain of Japanese quail in their first week of live. Five hundred Japanese quail (Coturnix coturnix japonica) was used in a randomized design experiment. The animals were distributed in twenty five groups of 20 quail. Each five group was randomly assigned to one of the next tratments: 1) Regular management without supplement in water (control); 2) Drinking water with supplemented with 100 ppb of Cr from Pic-Cr; 3) Drinking water with 200 ppb of Cr from Pic-Cr;4)Drinkin water supplemented with 100 ppb of Cr from Met-Cr; and 5)Water supplemented with 200 ppb of Cr from Met-Cr. Mean of experiment mortality was 1.2% and was not affected (P>0.10) by treatments. Treatment with 200 ppb of Cr from Met-Cr, increased (P<0.01)blood glucose (236.6 vs 299.8 mg/dL) and improve (P<0.05) final weight (36.93 vs 37.47 g) and weight gain (27.7 vs 29.12 g). Met-Cr inclusion in drinking water with independence of used level, increased 26% (P<0.01)blood glucose concentration (236.6 vs 297.9 mg/dL)and tended to increase (P=0.07)in 2.8% body weight (36.93 vs 37.97 g), and tended to improve (P=0.10) in 3.6% weigth gain (27.7 vs 28.7 g). Pic-Cr had not effect (P>0.10) on the variables. It is concluded that, chromium

supplementation in drinking water not affect the mortality of Japanese quail in trial in they first living week, and the inclusion of 200 ppb of chromium from chromium methionine increased blood glucose levels and weight gain.

Key Words: Chromium methionine, Picolinate, Japanese quail

1017   Dairy business analysis project: 1998 performance summary. M. J. Hoekema[1], R. Giesy[1], M. Sowerby[1], T. Seawright[1], P. Miller[1], A. Andreasen[1], C. Vann[1], and L. O. Ely*[2], [1]*University of Florida, Gainesville,* [2]*University og Georgia, Athens.*

The dairy business analysis project was initiated to measure and document the financial performance of diary businesses using standardized accounting measures so that uniform comparisons could be made among participants. Increased participation has allowed several comparisons to be made.Georgia and Florida comparisons were made this year. Florida dairies averaged $19.59/cwt income compared to Georgia dairies income of $18.67/cwt. Expenses were $17.65 for Florida and $17.24 for Georgia resulting in net farm income (NFI) of $1.94 for Florida and $1.44 for Georgia. Bst usage was sorted for no use, 0-15 doses /cow and >15 doses/cow resulting in NFI of $1.62, $1.91 and $2.09. Heifer raising was sorted for <.3, .3-.6 and >.6 heifers per cow resulting in NFI of $2.73, $1.61 and $1.38. Farms were sorted on feeding system: mixed ration-no crops, mixed ration- cropping, one-shot and partial grazing resulting in NFI of $1.64, $1.24, $2.11 and $3.97. The data was also sorted for herd size, level of production, milk sold per worker and frequency of milking.

Key Words: financial data

1018   Producing milk economically in Quebec by increasing forages in dairy cow rations. K. Valiquette*[1], D.G. Pellerin[1], G. Allard[1], D. Lefebvre[2], L.P. Vezina[3], P. Paquin[1], and D. Pellerin[1], [1]*Universite Laval,* [2]*PATLQ inc.,* [3]*Agriculture and Agri-Food Canada.*

In Eastern Canada good quality forages can be grown economically. Increasing the proportion of forages in dairy cow rations should lead to a decrease in milk production cost. The AGRITEL data base was used to select farms based on their milk production allowed by forages, half with a low (LF) and half with a high milk (HF) from forages. Data from those farms were collected over two production years (05-96 to 06-98). Herd size was similar for both farm groups, averaging 46 milking cows. Average milk yield was also similar at 7 221 kg per cow. Milk protein at 3.29% as well as milk fat at 3.96% (HF 3.97 % and LF 3.94%) did not differ between the two farm groups. Cows weighed 18 kg less on the HF farms (P<0.01). Farms feeding more forages also cultivated more land in forages resulting in lower ratios of cows per ha grown in forages, HF 0.92 and LF 1.23 (P<0.001). Based on the proportion of forages and concentrates in cow rations, it was calculated that 2 935 kg of the milk produced on HF farms could be associated to forage intake compared with 1 533 kg of milk on LF farms (P<0.001). Milk production gave an overall ratio of 3.16 kg of milk per kg of concentrate for the HF farms compared to 2.35 for the LF farms (P<0.001). Feeding cost per hL of milk produced was $2.54 cheaper on HF farms than on LF farms ($8.63 Vs $11.17, P<0.0001). This reduction in feeding cost was also associated with a decrease in veterinary costs of $0.24 per hL (P<0.01) suggesting that cows fed more forage were in better health. Overall the standardized work income per hL was significantly higher on HF farms compare to LF farms ($9.65 Vs $6.86, P<0.01).
Results suggest that, in Eastern Canada, increasing the proportion of forages in dairy cow rations could produce milk more economically. Furthermore this approach is environmentally sound as well as providing producers with a better remuneration for their work.

Key Words: high Forage rations, Dairy cattle, feeding Costs

1019   Impact of improving environmental conditions during milking time on milk production. S. Pietrosemoli*[1], J. Cubillan, and A. Del Villar, [1]*Facultad de Agronomia. La Universidad del Zulia. Venezuela.*

In a six-month trial, twelve cross breed Brown Swiss x Cebu cows were used in order to evaluate the effect of improving the environmental conditions during milking time on milk production. The trial was performed in a commercial farm located south of Maracaibo's Lake, Venezuela, in a sub humid tropical forest. Animal grazed tropical grasses: *Brachiaria*

brizantha, Cynodon nlemfuensis, Echynocloa polystachia and *Panicum maximun* , and were supplemented with mineral salts and molasses *ad libitum*. All the animals were similar in weight, age, lactation period and numbers of calving. Blocks were conformed using average milk production before trial as parameter. A switch back design with two treatments was used, considering residual effect. Treatment 1 **T1** was traditional milking system, using calve to stimulate milking. Treatment 2 **T2** was **T1** + improved environmental conditions: five km/h wind produced by fans and one minute water shower every half an hour, during four hour afternoon milking time. Information was analyzed using GLM procedures of Statistical Analysis System. Milk average was 6.06 lt/cow/day. Statistical differences (P ≤ 0,0001) were detected between treatments. Total milk production of **T2** was 8,34 % higher than **T1**. It was concluded that improving environmental conditions during milking time enhance milk production of grazing cows.

Key Words: Environmental conditions, Grazing cows, Milk production

1020   The effects of six times a day milking in early lactation on milk yield, milk composition, body condition, and reproduction. A. H. Sanders*[1], M. A. Varner[1], and R. E. Erdman[1], [1]*University of Maryland, College Park.*

Seventy-four cows on a large commercial dairy were selected at calving and assigned to one of three groups 1) milked three times a day (3X) control, 2) milked six times a day (6X) treatment, 3) milked 3X herd cohorts. The treatment period was the first 42 days postpartum, after which all cows were milked 3X. Daily milk yield was recorded for 38 weeks. During weeks 2 through 14, weekly samples were analyzed for fat, protein, and somatic cell count (SCC), and body condition was monitored for treatment and control groups. Cows in the control and treatment groups were bred by artificial insemination at 69 to 76 days postpartum following ovulation synchronization. Pregnancies were confirmed by ultrasound at least 26 days after insemination, cows observed returning to estrus were assumed not to be pregnant. Data was analyzed by analysis of variance using the Mixed procedure of SAS® with a least squares model which accounted for treatment group, week postpartum, parity, and all possible interactions, randomized for cow within treatment group. Previous adjusted lactation record was used as a covariate for milk yield. Average daily milk yield was highest for all cows milked 6X, although this difference was not significant. For multiparous cows, those milked 6X (41.1 kg/d, SEM = 1.12) produced more milk than those in the control group (38.2 kg/d, p<0.01) and cohorts (37.9 kg/d, p<0.05). Fat percent was not significantly affected by treatment, but fat yield for multiparous cows milked 6X was 0.13 kg/d (SEM = .05) higher (p<0.01) than 3X controls (1.61 and 1.48 respectively). While percentage protein was lower (p<0.05) for multiparous cows milked 6X (2.87%) than 3X controls (2.98%), protein yield was 0.12 kg/d higher (SEM = .04, p<0.01).There was no significant difference in conception rate between cows milked 6x and controls (31.0%, and 23.3% respectively). There were no significant differences in SCC. Body condition was not affected by treatment. Milking cows six times daily in early lactation may be an effective way of increasing milk yield, without negatively impacting milk quality or cow health.

Key Words: Milking frequency, Production, Reproduction

1021   Relationship between milk and plasma urea nitrogen concentrations and feeding time. E.E. Ferdinand*, J.E. Shirley, M.J. Meyer, A.F. Park, M.J. VanBaale, and E.C. Titgemeyer, *Kansas State University, Manhattan.*

Eight Holstein cows were used to determine the relationship between milk urea nitrogen (MUN), plasma urea nitrogen (PUN), and feeding time. We first established that MUN was similar (P>.05) among quarters by comparing milk samples from each quarter just prior to milking. In order to determine if collecting a sample of milk from a quarter influences the MUN in samples taken later, samples were obtained from the right front quarter (RF) at 2, 4, 6, and 8 h after the a.m. milking and from the left front quarter (LF), right rear (RR), and left rear (LR) at 4, 6, and 8 h after the a.m. milking, respectively. MUN in samples obtained from RF at 4 h was lower (P<.01) than corresponding samples taken from LF, but samples from RF at 6 and 8 h did not differ from corresponding samples obtained from RR and LR. We concluded that by 6 h the effect of previous milking on MUN concentration disappeared because of dilution. To determine the influence of feeding time on MUN concentrations, cows were fed half of their normal p.m. feeding, injected

with oxytocin at the subsequent a.m. milking to reduce residual milk and offered surplus feed after the a.m. milking. Milk samples were collected at 2, 4, 6, 8, 10, and 12 h after feeding from RF,LF, RR, LF, RF, and LF quarters, respectively. Blood samples were obtained from the coccygeal vein at hourly intervals after feeding with the last sample collected 12 h after feeding. MUN in samples obtained at 2, 4, 6, and 8 h was similar. MUN at 10 h was similar to that at 2 and 8 h, lower ($P<.05$) than that at 4 and 6 h and higher ($P<.05$) than that for the 12 h sample. PUN peaked at 2 h post feeding then gradually declined through 12 h post feeding. MUN peaked at 6 h post feeding then declined. Time after feeding significantly influenced PUN and MUN concentrations.

Key Words: MUN, PUN, Dairy

1022   Measurement of critical collapse pressure difference and touch point pressure difference using various milking machine liners. J. S. Kikta*[1] and S. B. Spencer[2], [1]*John Kikta, Dairy Consultant,* [2]*Spencer Consulting.*

Critical collapse pressure difference is the pressure difference between atmospheric pressure and the pressure in the pulsation chamber at the point where the first movement in the liner wall from the fully open position is detected. The touch point pressure difference is also the pressure difference between atmospheric and the pulsation chamber pressure, but at the point where the walls of the liner first make contact as they move toward the fully closed position. Critical collapse pressure difference and touch point pressure difference were measured on three of each of the milking machine liner types. Liners were mounted in an appropriate shell and placed over a light source. The pulsation chamber was then gradually pressurized using a vacuum/pressure pump. The pressure difference was measured using a mercury column at the critical collapse point and the touch point as determined by visual inspection. The results of the test were analyzed using a two-way Analysis of Variance. Critical collapse pressure difference and touch point pressure difference were significantly ($P<0.05$) different by milking liner type. Least Square means of critical collapse pressure difference and touch point pressure difference ranged from 2 kPa to 11 kPa and 12.5 kPa to 19 kPa, respectively. The Least Square means for touch point pressure difference had a bimodal distribution. Liners with a non-round barrel shape had low critical collapse pressure differences.

Key Words: milking machine liner, touch point pressure difference, critical collapse pressure difference

1023   Clinical and sub-clinical mastitis in cows fed monensin. J.I.D. Wilkinson*, H.B. Green, J.T. Symanowski, D.G. McClary, J.R. Wagner, J.S. Davis, and M.R. Himstedt, *Elanco Animal Health, Greenfield, IN.*

Holstein cows (342 primiparous and 598 multiparous) were fed 0, 8, 16 or 24 ppm monensin in total mixed rations (dry matter basis), using a randomized complete block design over nine locations. Treatment began 21d before expected parturition and continued through lactation (L1), the dry period and subsequent calving. Clinical mastitis and antibiotic therapy were recorded. Somatic cells counts (SCC) were determined on weekly milk samples. At three locations, 249 cows continued the same treatments for 200d of the subsequent lactation (L2). At these sites quarter milk samples were cultured after each calving, at dry-off, and at the end of the study (event samples), and at approximately 56d intervals (calendar samples). Monensin had no effect on the incidence of clinical mastitis in L1. In L2, the animal rate for clinical mastitis in the 24 ppm group was lower than controls and there was a linear trend across doses for reduced mastitis. Mean SCC was higher in the 8 ppm group than controls in L1, but there was no linear trend and there were no treatment effects in L2. Approximately 10% of samples monitored for sub-clinical infection cultured positive. Animal and quarter prevalences were similar across dose levels for both event and calendar sampling schedules. Monensin did not adversely affect the susceptibility of cows to clinical or sub-clinical mastitis, or the frequency with which antibiotics were used to treat mastitis.

Parameter	0 ppm	Monensin 8 ppm	in ration 16 ppm	24 ppm
Clinical mastitis in L1				
Animal rate	0.463	0.435	0.400	0.420
Quarter rate	0.190	0.187	0.167	0.180
Cases/1000 quarter days-at-risk	0.862	0.837	0.722	0.748
Clinical Mastitis in L2				
Animal rate[#]	0.607	0.502	0.479	0.427*
Quarter rate	0.284	0.229	0.221	0.195
Cases/1000 quarter days-at-risk	1.894	1.689	2.014	1.531
SCC 1,000				
L1	74.3	88.1*	80.8	74.3
L2	84.0	97.1	95.1	65.7
Sub-clinical mastitis, % positive (n)				
Event samples	10.0(1101)	10.6(1104)	9.8(1087)	8.9(1097)
Calendar samples	10.1(2655)	10.4(2815)	10.7(2711)	9.4(2800)

[#]$P<0.1$ for linear trend. *$P<0.1$ vs control.

Key Words: Monensin, Mastitis

1024   Environmental effects on somatic cell count in Holstein cows from Parana State, Brazil. A. Ostrensky[1], N.P. Ribas[1], H.G. Monardes[2], R. Almeida*[1], D.R. Veiga[3], and J.A. Horst[3], [1]*Universidade Federal do Parana, Curitiba - PR, Brazil,* [2]*McGill University, Montreal, Canada,* [3]*Assoc. Paranaense Criadores Bov. Raca Holandesa, Curitiba - PR, Brazil.*

Somatic cell count (SCC) indicates the presence of intramammary infection in cows. So it may be used on mastitis control, on payment systems based on milk quality and on udder health diagnosis. The goal of this study was to evaluate the effects of some environmental factors on milk SCC, on somatic cell score (SCS) and on somatic cell logarithmic transformation (SCL). A data set containing 640,937 monthly test-day records from 40,333 Holstein cows distributed in 378 supervised herds from Holstein Association from Parana State, Brazil, covering a period from January 1994 to December 1998 was analyzed. General Linear Model procedures (SAS, v. 6.12, 1991) were used for the study of the following fixed effects: age of cow at calving, calving season, month-year of test, days in milk, milking frequency and age of the sample. Means and standard deviations of SCC, SCS and SCL were 556,626 835,004 cells/ml, 4.461 1.789 and 8.105 1.789, respectively. All the factors included in the model had a highly significant ($P<0.01$) effect on the three traits analyzed, except calving season on SCC and milking frequency on all three traits. The trends suggest a steady improvement on the somatic cell count with time. It was also observed clearer results from the two transformed traits (SCS and SCL) than from SCC. ®±±±

Key Words: Somatic cell count, Somatic cell score, Environmental factors

1025   Transition management: Effect of a post-calving drench (RumenKickstart ®) on feed intake and milk production in primiparous Holstein/Friesian cows. R. H. Phipps* and D.E. Beever, *Centre for Dairy Research, Department of Agriculture, The University of Reading, UK.*

For three weeks prior to calving 30 primiparous Holstein-Friesian cows received a TMR containing on a DM basis 45% grass silage, 15% maize silage, 25% barley straw, 6% soybean meal, 4% molassed sugar beet feed and 1% minerals. The CP, NDF, starch and ME contents of this ration was 10.3 45.4, 12.9% DM and 11.0 MJ/kg DM. At calving all heifers received a TMR containing 42% maize silage, 14% grass silage, and 46% concentrate, and had CP, NDF, starch and ME values of 20.7, 29.9, 23.0% DM and 12.1 MJ/kg DM. Heifers were randomly allocated at calving to either a treated (T) or control (C) group. Heifers in group T received within 24 h after calving 30 l of lukewarm water containing 500 ml of 1,2 mono-propylene glycol and other ingredients including calcium, sodium, copper, vitamins A, D3 and E, yeasts, plant extracts, selected amino acids, electrolytes and enzymes. During the first five weeks of lactation when individual intakes were recorded there was a small positive

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but non-significant mean increase of 0.6 kg DM/d in favour of group T. However at week 2, treatment increased (P<0.01) DM intake from 9.5 to 10.9 (s.e.m 0.56)kg/d. During the first five weeks of lactation milk yields for group T were increased (P<0.05)from 19.2 to 21.8 (s.e.m 0.81) kg/d. After week 5 of lactation, heifers were group fed, but still milk recorded. Analysis of the milk records between weeks 2-20 of lactation showed that the treated heifers produced a total of 3486 kg milk (27.7 kg/d) compared with 3176 kg milk (25.2 kg/d) (s.e.m. 94.7) for the control group. This difference was significant (P<0.05). Milk quality was not recorded. The results show that the drench increased both feed intake and milk production in early lactation and that the initial increase in milk production was sustained for at least 20 weeks.

Key Words: Transition management, Rumen drench, Milk production

1026   Influence of late lactation protein supplementation on full lactation productive and reproductive performance of Holstein cows. P.H. Robinson*[1], J.M. Moorby[2], M. Arana[3], R. Hinders[4], T. Graham[5], L. Castelanelli[6], and N. Barney[7], [1]*UCCE, Davis, CA,* [2]*IGER, Aberystwyth, UK,* [3]*UCCE, Stockton, CA,* [4]*Hinders Nutr. Cons., Acampo, CA,* [5]*Graham & Assoc., Davis, CA,* [6]*Castelanelli Dairy, Lodi, CA,* [7]*Lignotech USA, Overland Park, KS.*

Recent studies report increased CP levels of the close-up dry cow ration, to about 15% DM, improve lactation performance of dairy cows. Holstein cows were assigned to close-up groups that were offered 1) Control, C: 10.8% CP ration based on corn silage, alfalfa cubes, oat hay, corn and barley grain, or 2) Supplemented, S: 13.4% CP as C plus .8 kg/d per cow of a supplement (60% SoyPass®, 40% others). Heifers (C, 37; S, 43) and mature cows (C, 79; S, 81) were used. After calving, treatment with BSt, movement through production groups, and reproduction were determined by the herd manager. Production parameters were pooled to means for cows that completed the lactation (others were excluded) and analyzed by ANOVA. Time close-up varied (1-19 d), so cows were allotted to 4 time groups for linear regression. As their time in the close-up group increased, primiparous cows on treatment S produced more milk (C: .15 kg/d and S: .29 kg/d per d close-up; P=.26 and .06), more milk protein (C: 2.1 g/d and S: 7.3 g/d per d close-up; P=.69 and .06), days in milk (DIM) at BSt start increased for both (C: 1.74 d and S: 1.59 d per d close-up; P=.09 and .11), DIM at BSt end increased for S cows (C: 1.30 d and S: 2.47 d per d close-up; P=.22 and .04) and lactation length increased for both (C: .76 d and .92 d per d close-up; P=.03 and .01). As time close-up increased, mature cows on either CP ration produced more milk fat (C: 8.7 g/d and S: 8.7 g/d per d close-up; P=.01 both), increased days at 1st conception (C: 1.35 d and S: 1.37 d per d close-up; P=.10 both)and services per conception (C: .054 and S: .048 d per d close-up; P=.06 and .08). Body condition and locomotion scores, and time in production groups were not affected by CP or time close-up for either parity. Results suggest increasing close-up CP from 10.8 to 13.4% only enhanced productive performance of primiparous cows with little effect on reproductive performance on cows of either parity. Increased time close-up enhanced productive performance regardless of CP or parity, but reduced reproductive performance of mature cows.

Key Words: Dry Cows, Close-up, Transition

1027   Intestinal disappearance, mesenteric and portal appearance of amino acids (AA) in dairy cows fed rumen protected methionine (RPM). R. Berthiaume*[1], P. Dubreuil[2], M. Stevenson[3], B.W. McBride[1], and H. Lapierre[4], [1]*University of Guelph, Guelph, ON, Canada ,* [2]*Universite de Montreal, QC, Canada,* [3]*Degussa Huls, Burlington, ON, Canada,* [4]*Agriculture & Agri-Food Canada, Lennoxville, QC, Canada.*

An experiment was conducted to compare the rates of disappearance of AA from the small intestine and their net appearance in the blood draining only the small intestine (Mesenteric-Drained Viscera (MDV)) and the whole GIT (Portal-Drained Viscera (PDV)) of cows fed a diet supplemented or not with RPM and to determine the effect of RPM on milk protein production. Five lactating dairy cows (118 ± 4 DIM) equipped with duodenal only (n=3) or duodenal and ileal cannulae (n=2) were fed a TMR with 0 or 72 g/d of RPM (Mepron® M85, Degussa Hüls) in a completely randomised design with two 14-d periods. Two cows with duodenal cannulae were also implanted with chronic catheters in the artery, mesenteric and portal veins. Animals were fed 12 times daily. Chromic oxide was used as a marker to determine digesta flow rates. On day 12 and 13, a total of eight hourly digesta samples were collected

while on day 14 of each experimental periods, six hourly blood samples were simultaneously collected from arterial, mesenteric and portal vessels. Adding RPM to the diet increased (P=0.05) the duodenal flux of Met (80.8 vs 37.2 ± 10.8 g/d) leading to a higher (P=0.01) digestibility of Met in the whole intestine (75.7 vs 59.4 ± 2.6 %). Eighty two percent of Met from RPM disappeared from the small intestine. Arterial plasma Met concentrations were numerically increased (P= 0.16; 45 vs 18 ± 4.8 μM). Milk production (16.9 vs 17.2 ± 0.6 kg/d) and composition were unaffected, except for an elevation (P=0.03) in lactose (5.24 vs 4.97 ± 0.03 %). Overall, disappearance of EAA across the small intestine was equivalent (98.8%) to their MDV flux while the PDV:MDV ratio varied from 37.7% for Thr to 76.3% for Phe. PDV:MDV ratio for Met was 66.2%. Feeding RPM did increase absorption of Met but only 20% of the additional Met absorbed reached the portal vein.

Key Words: methionine, rumen protected, dairy cows

1028   IMPEDANCE of subdermal tissue, and its relationship to body condition score of dairy cows along lactation. F. N. Domatob-Fokum* and S. L. Spahr, *University of Illinois, Urbana.*

Body condition score (BCS), a very useful field tool for estimation of changes in body tissue reserves is time consuming and subjective. The relationship between impedance of subdermal tissue and body condition score was determined as a potential for the development of a low cost, portable, digital impedance sensor for BCS. Five multiparous Holstein dairy cows were implanted with pacemaker electrodes at rib, loin, and rump. Digital impedance of subdermal tissue surrounding each implanted probe was measured with a 16-kHz impedance hand-held meter in alternate days from three weeks before calving to 17 weeks post calving. Cows were scored for body condition every two weeks on a scale of one (emaciated) to five (obese). Retention of implants at the rump site was considerably high compared to the rib and loin. Split-plot analysis of the variance indicated subdermal tissue impedance differed along lactation at all body sites. Subdermal tissue impedance increased during the late dry period and peaked at calving (783 ohms), decreased sharply till week nine (349 ohms) and increased to 414 ohms at week 15. Although slight differences existed, all body sites could be used to predict BCS. An inverse relationship was recorded between BCS and subdermal tissue impedance. At BCS range of 1.84 to 4.30 pre calving, subdermal tissue impedance ranged from 148 to 1850 ohms, and at BCS range of 1.8 to 3.80 post calving, subdermal tissue impedance ranged from 187 to 1408 ohms for all body sites. At BCS of 2.6 0.11, subdermal tissue impedance read 489.2 111. Regression of BCS from subdermal tissue impedance post calving showed R^2 values of 0.28 (rib), 0.46 (loin), and 0.27 (rump). Recording of subdermal tissue impedance removed most of the subjectivity of BCS, but substantial development is needed to reduce time required for data collection, and permanent retention of pacemaker implants on cows before expecting a commercial impedance sensor for scoring cows automatically. Determination of body condition score from subdermal tissue impedance needs further research at higher frequency levels. μμμμμ±

Key Words: Impedance, subdermal tissue, body condition score

1029   Reproductive efficiency of cows fed monensin. H.B. Green*, J.T. Symanowski, D.G. McClary, J.R. Wagner, J.I.D. Wilkinson, J.S. Davis, and M.R. Himstedt, *Elanco Animal Health, Greenfield, IN.*

Holstein cows were fed 0, 8, 16 or 24 ppm monensin in total mixed rations (dry matter basis), using a randomized complete block design over nine locations. Treatment began 21d before expected parturition and continued through lactation, the dry period and subsequent calving (L1). At three locations, 249 cows continued on treatment for 200 d of the second lactation (L2). In L1, 560 multiparous and 309 primiparous animals reached the breeding period of 50 to 200 days in milk (DIM). For combined parities, no treatment effects were observed on days to first sign of estrus or overall conception rate in either lactation, nor did monensin affect pregnancy rate or gestation and dry period lengths. Days to first service were not affected in L1, but were increased at 8 ppm and decreased at 24 ppm in L2. First service conception rate was significantly lower for the 24 ppm group compared to control during L1 but not during L2. As a result, days open during L1 and calving interval were longer for the 24 ppm group than control. Female calves from monensin treated cows weighed more at birth than controls, but

birth weights of male calves were not different. There was no difference in calving difficulty between treatment groups. Average daily gain of female calves to 28 d of age was not different between groups. Monensin did not affect multiple birth rate or calf gender ratio.

Parameter	Lactation	Monensin 0 ppm	8 ppm	16 ppm	24 ppm
Number of cows					
(9 sites) 50-200					
DIM	L1	218	211	219	221
Inseminated	L1	213	209	213	216
Conceived	L1	181	177	170	179
Calved	L1	160	155	149	164
(3 sites) 50-200					
DIM	L2	60	61	55	60
Inseminated	L2	58	56	54	59
Conceived	L2	48	47	44	46
Days to 1st	L1	84.1	84.7	86.9	83.6
service	L2[a]	89.7	97.5	89.0	83.1
1st service	L1[#]	0.499	0.427	0.448	0.378*
conception rate	L2	0.439	0.560	0.366	0.424
Overall conception	L1	0.431	0.415	0.404	0.379
rate	L2	0.435	0.458	0.352	0.326
Days open	L1	99.8	104.6	100.4	107.7*
	L2	102.0	101.4	111.3	105.8
Calving interval,					
days [#]		380.8	383.6	381.8	389.6*
Female calf wt,					
kg[#]		40.8	43.0*	42.8*	43.5*
Male calf wt,					
kg		45.6	46.9	46.2	45.9

*P<0.1 vs control, [a]P<0.1 treatment χ^2 test , [#]P<0.1 linear trend

Key Words: Monensin, Reproduction

1030 Management tools for assessing passive immunity transfer in dairy calves. K.M. Kouri*, D.D. LaCoss, D.E. Watkin, J.W. Barlow, and J.R. Knapp, *University of Vermont, Burlington, VT.*

Twenty-three Holstein and Jersey calves were used to evaluate effects of colostrum management and to evaluate three methods of determining adequate passive immunity transfer. Calves were fed 2L of colostrum at birth and another 2L at 12h post-partum (pp). Blood was sampled before colostrum feeding and at 6 and 24h pp and serum collected. Serum was immediately tested for total serum protein using a refractometer and for serum IgG using the Midlands Bioproducts Quick Test. Serum and colostrum were stored and assayed later using a radioimmunodiffusion (RID) kit from VMRD, Inc. Differences in serum IgG as determined by refractometer and RID were tested using the SAS-GLM procedure. The validity of the Quick Test was compared using the serum IgG values determined by RID. The refractometer results differed from RID results 7.3% of the time, while the Quick Test differed from the RID 9.7% of the time. Regression equations were developed between total serum protein measured by the refractometer and IgG levels measured by RID at both 6 and 24h pp. The equations agree with previously published equations for serum IgG at 24h pp. As expected, significant differences were found between pre-feeding and post feeding IgG levels (p≤.01). Differences (p≤.01) were also observed between IgG levels at 6 and 24h pp, with levels increasing over time. This would suggest that the second feeding of 2L colostrum at 12h pp significantly increased the probability that passive transfer occurred by 24h pp. Adequate passive transfer (serum IgG $\geq$ 10 mg/dl) was achieved in 20 of the 23 calves. In summary, the Quick Test and refractometer are both valuable tools for assessing a calf's IgG status in the first 24 hours after birth. Beyond the use of these tools, passive transfer in neonatal dairy calves can be most easily achieved with a well planned and implemented colostrum feeding protocol based on the use of high quality colostrum.

Key Words: Colostrum, Immunoglobulin G, Calf Nutrition

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