DMI (P<0.05), however the bacterial nitrogen produced per unit organic matter consumed was not altered by treatment. Organic matter digestibility was linearly increased (P<0.05) by decreasing levels of DMI, while NDF digestibility was unaltered by treatment. Nitrogen excretion in the feces and urine increased linearly (P<0.05) with increasing intake of nitrogen and dry matter. Nitrogen was apparently more digestible for those heifers receiving a lower amount of dry matter compared to those receiving a greater amount (P<0.05). While apparently absorbed nitrogen increased linearly as intake increased (P<0.05), apparently retained nitrogen increased linearly but with a decreasing rate as the intake of dry matter approached the highest level of intake (linear and quadratic, P<0.05). Nitrogen retained as either a proportion of nitrogen consumed or nitrogen absorbed was quadratically affected by treatment (P<0.05) with nitrogen efficiency peaking at intermediate levels of intake.

Key Words: Nitrogen Efficiency, Dairy Heifers, Bacterial Nitrogen

211 The effect of essential plant oils on milk production and composition from lactating dairy cows and on silage fermentation and aerobic stability of corn silage. R. J. Schmidt*[1], D. H. Kleinschmit[1], J. M. Ladd[1], J. E. Lynch[1], L. Kung, Jr.[1], P. G. Williams[2], and R. Losa[3], [1]*University of Delaware, Newark,* [2]*Akzo Nobel LLC, Davis, CA,* [3]*CRINA S.A. Switzerland.*

Alternative feed additives have been studied and the use of plant secondary compounds is a promising option. A blend of essential oil components (CRINA Ruminant, CRINA S.A., Switzerland) was fed to lactating cows to study its effect on intake and milk production. Cows were fed a TMR of 15% alfalfa silage, 10% alfalfa hay, 25% corn silage, and 50% concentrate (DM basis). For a 2-wk pretreatment period all cows were fed 50 g of a limestone/CRINA blend that was mixed into the TMR to provide a daily intake of 0.6 g of CRINA/cow/d. At the start of an 8 wk treatment period cows were blocked on lactation number, pretreatment milk production and days in milk, and randomly allocated to one of two treatments: 1) 100 g of limestone or 2) 100 g of limestone/CRINA (1.2 g CRINA/cow/d). Cows fed CRINA ate 1.9 kg more DM/d and produced 2.7 more kg of 3.5% FCM/d than did cows fed the control diet ($P < 0.05$). Milk composition was unaffected by treatment. CRINA was also added to chopped corn forage (30% DM) to evaluate its effect on silage fermentation and aerobic stability. Treatments were: 1) no additive, 2) 2.5 g of CRINA/25 kg of wet forage, 3) 5.0 g CRINA/25 kg of wet forage, or 4) a buffered propionic acid based product, 4 lb/ton of wet forage (Kemin Industries, West Des Moines, Iowa). After ensiling, addition of CRINA had no effect on silage fermentation or the aerobic stability of corn silage. As expected, addition of the buffered propionic acid based product increased the concentration of propionic acid ($P < 0.05$) and decreased the yeasts in silage (4.45 vs. 5.16 log cfu/g, $P < 0.05$) but only numerically improved aerobic stability (47.5 vs. 59.5 h) when compared to untreated silage. The findings of this study show that CRINA was unable to affect silage fermentation or aerobic stability but it increased DM intake and milk production in dairy cows.

Key Words: Essential Oils, Milk Production, Silage

212 The effects of *Lactobacillus buchneri* 40788 and damage to the corn ear on the fermentation, aerobic stability, and production of mycotoxins in corn silage. R. S. Teller*, R. J. Schmidt, and L. Kung, Jr., *University of Delaware, Newark.*

We examined the effects of damaging ears of corn and microbial inoculation on the fermentation, aerobic stability, and production of mycotoxins in whole plant corn silage. Ears of corn on several plants were slashed, exposing damaged kernels to the environment. Seven days later, whole plant corn was harvested at 35% DM and ensiled in 20-L laboratory silos (packing density of 227 kg DM/m^3 or 14 lb/ft^3) in quadruplicate as one of the following treatments: 1) no inoculation and undamaged ears of corn (CC), 2) inoculation with *L. buchneri* 40788 (400,000 cfu/g of fresh forage) and *Pediococcus pentosaceus* (100,000 cfu/g) (Lallemand Animal Nutrition, Milwaukee, WI) and undamaged ears of corn (IC), 3) no inoculation and damaged ears of corn (CD), 4) inoculation and damaged ears of corn (ID). After 126 d of ensiling, regardless of damage to the ear, inoculated silages had higher concentrations of acetic acid (1.59 vs. 0.87%, $P < 0.05$), lactic acid (4.39 vs. 3.47%, $P < 0.05$), and 1,2 propanediol (0.87 vs. 0.0%, $P < 0.05$) than did uninoculated silages. Inoculated silages had fewer yeasts (0.61 vs. 3.33 log cfu/g) and thus were more aerobically stable (74 vs. 43.3 h, $P < 0.05$) than were uninoculated silages. Although initial numbers of yeasts and molds and concentrations of deoxynivalenol (DON) and fumonisin B1 (FB1) toxins were not different in fresh corn forage, between forage with damaged and undamaged ears, silage with damaged ears had higher concentrations of DON (3872 vs. 1009 ppb, $P < 0.05$) and FB1 (9.05 vs. 4.07 ppm, $P < 0.05$). Silages made from corn with damaged ears tended to have higher concentrations of ethanol (5.40 vs. 4.31, $P < 0.06$). Addition of *L. buchneri* 40788 and *P. pentosaceus* altered silage fermentation and improved the aerobic stability of the corn silage, regardless of damage to the ear before ensiling, but it was not able to prevent an increase in the production of mycotoxins during ensiling.

Key Words: Aerobic Stability, Lactobacillus buchneri, Mycotoxins

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213 Effects of providing supplemental methionine (Met) in the form of Smartamine™ M or 2-hydroxy-4-methylthio butanoic acid isopropyl ester (HMBi) to prepartum and early lactation dairy cows on feed intake and lactational performance. R. S. Ordway*[1], N. L. Whitehouse[1], A. M. McLaughlin[1], C. G. Schwab[1], and B. K. Sloan[2], [1]*University of New Hampshire, Durham,* [2]*Adisseo USA, Inc., Alpharetta, GA.*

Sixty primiparous (n=18) and multiparous (n=42) Holstein cows were blocked according to parity and expected calving date and assigned randomly to one of three dietary treatments: 1) basal diet, 2) basal diet plus HMBi, or 3) basal diet plus Smartamine™ M. Treatments were initiated 21 d before expected calving and continued through 140 d postpartum. Methionine supplements were added to the diet of each cow in amounts needed to achieve predicted concentrations of Lys (7.19%) and Met (2.37%) in metabolizable protein of 3.0:1.0 (NRC, 2001). It was assumed that 50% of the HMB in dietary HMBi is converted to metabolizable Met and that 80% of the Met in SmartamineTM M is absorbed. Prepartum DM intake (13.5 kg/d), body weight (687 kg), and body condition score (3.81), and postpartum milk yield (42.0 kg/d), milk fat yield (1549 g/d), milk fat content (3.66%), milk true protein yield (1192 g/d), and milk urea nitrogen content (12.9 mg/dl) were not different among treatments. Postpartum DM intake and body condition score were greater and milk/DM intake and milk N/feed N ratios were less for cows fed HMBi than for cows fed the control and Smartamine™ M diets (22.9 vs. 22.0 and 21.4 kg/d; 3.37 vs. 3.26 and 3.28; 1.92 vs. 2.00 and 1.98; 0.32 vs. 0.33 and 0.34, respectively). Milk protein content was greater for Smartamine™ M (2.87%) and HMBi (2.81%) than for control (2.72%). Concentrations of Met and Met+Cys in total plasma AA were different among treatments with values for Smartamine™ M being the highest followed by HMBi and control (2.10, 1.43, and 1.15% and 3.92, 3.12, and 2.73%, respectively). The results indicate that both HMBi and Smartamine™ M are effective in providing metabolizable Met, but clarification of their relative contributions to metabolizable Met is still needed.

Key Words: Lactating Cows, Rumen Protected Methionine, Methionine Analogs

214 Comparison of Holstein, Brown Swiss and Jersey cows for age at first calving and first calving interval. T. B. Garcia-Peniche*[1], B. G. Cassell[1], I. Misztal[2], and R. E. Pearson[1], [1]*Virginia Polytechnic Institute and State University, Blacksburg,* [2]*University of Georgia, Athens.*

The objective of this study was to examine breed differences due to geographic location and birth season on age at first calving and first calving interval, and the effect of season of first calving on first calving interval in Holsteins and Jerseys and Holsteins and Brown Swiss housed on the same farm. Data were analyzed for five (R5) or seven regions (R7) within the United States. The geographic division definition influenced the effect of season of first calving on first calving interval in Holstein-Jersey farms (P=0.68 in R5 and P<0.01 in R7). Holsteins housed with Jerseys (HJ) had shorter first calving intervals and calved at younger

ages than Holsteins housed with Brown Swiss (HB). Data from seven states (California, Oregon, Arizona, Texas, Florida, Ohio and Wisconsin) were also analyzed (S7). In general, Jerseys had the youngest age at first calving and shortest first calving interval, except in the Northwest for age at first calving, and in Florida, Texas and California for first calving interval. Holsteins and Brown Swiss did not differ for first calving interval (P=0.98 in R5, P=0.33 in R7, and P=0.09 in S7). Cows in Texas and Florida had the longest first calving interval (HB 481.4 ±20.4, Brown Swiss 448.7 ±23.7, HJ 482.9 ±20.7, and Jerseys 461.2 ±20.9 for Florida, and 487.9 ±11.4, 475.9 ±11.6, 491.9 ±16.1, and 477 ±16.8 for Texas, respectively). Brown Swiss had the shortest first calving interval in Texas, Florida and California. Conclusions: Brown Swiss showed evidence of heat stress resistance, the geographic definition affected some of the results, and management practices changed Holsteins' performance depending on their herdmates' breed. Longer calving intervals might not be entirely due to lower fertility, but also due to longer voluntary waiting period to breed the cows.

Key Words: Breed Comparison, Age at First Calving, First Calving Interval

215 One-time oral nucleotides enhance immune function of newborn beef calves. C. E. Oliver*[1], F. Philippe[2], G. Gaillard[2], R. B. Danielson[1], W. L. Keller[1], C. Rupprecht[3], M. L. Bauer[1], and C. S. Park[1], [1]*North Dakota State University, Fargo,* [2]*Ecole Superieure D'Agriculture D'Angers, France,* [3]*Rabies Laboratory, Centers for Disease Control and Prevention, Atlanta, GA.*

The aim of this study was to determine the effect of a one-time oral dose of nucleotides at birth on calf health and immune status. Twelve colostrum-deprived, newborn, beef calves (36.9 ± 1.4 kg initial body weight) were assigned randomly to either milk replacer only or milk replacer plus nucleotides. Nucleotides were supplemented at 10 times the level found in cow milk (monophosphate form of adenosine = 0.08, cytidine = 2.28, guanosine = 0.96, inosine = 1.28, and uridine = 20.6 μmol/kg body weight per d). Milk replacer was fed by dry powder weight at 0.7% of the birth weight of each calf. Milk replacer was fed reconstituted with 2 quarts warm water within 2 h of birth. Treatment calves received nucleotides in the milk replacer at the first feeding only. Other feedings in first 24 h for both groups were milk replacer only. Thereafter, calves were allowed to suckle dams. A rabies vaccine was administered at birth. Calves were weighed on d 0, 7, 14, and 21. Scours incidence was scored [2-point scale (0 = normal; 1 = scours)] daily for 3 wk. Morbidity, mortality, and treatment were recorded. Jugular blood was drawn from each calf immediately after birth (prior to feeding or other post-partum processing); at h 6, 12, 24, and 48; and d 7, 14, and 21, and analyzed for glucose, nonesterified fatty acids (NEFA), haptoglobin, immunoglobulins G (IgG) and M (IgM), and rabies vaccine titer. Nucleotide supplementation did not affect (P #8805 0.25) body weight, scours score, mortality, or serum glucose, NEFA, haptoglobin, or rabies titer. Nucleotide-fed calves tended to have higher IgG levels (P = 0.08) than controls (251.7 ± 26.8 vs 175.0 ± 28.3 mg/dL). IgM was higher (P = 0.03) in nucleotide-fed calves than in controls (70.0 ± 9.9 vs 34.0 ± 10.2 mg/dL). Results suggest that a one-time oral dose of nucleotides at birth may enhance immune status of neonatal beef calves by increasing immunoglobulin levels.

Key Words: Nucleotide, Calf, Immune Function

216 Insulin sensitivity in lactating dairy cows and neonatal calves: Comparison of the minimal model and the hyperinsulinemic euglycemic clamp. C. C. Stanley*[1], C. C. Williams[1], H. G. Bateman, II[1], D. T. Gantt[1], J. C. Roberts[1], P. T. Richardel[1], J. C. Lovejoy[2], and E. Ravussin[3], [1]*LSU AgCenter, Baton Rouge, LA,* [2]*Bastyr University, Kenmore, WA,* [3]*Pennington Biomedical Research Center, Baton Rouge, LA.*

Nine neonatal calves and twelve lactating cows were used to compare the minimal model (MM) computer analysis of the frequently sampled glucose tolerance test (FSIGT) to the hyperinsulinemic euglycemic glucose clamp (EC) in assessing insulin sensitivity (S_I). During the FSIGT glucose was administered (0.3g/kg BW) followed 20 min later by insulin administration (0.03 IU/kg BW) through a jugular catheter. Blood samples were collected relative to glucose administration for a 6 hr period for measurement of plasma glucose and insulin concentrations which were used in the MM to derive S_I . The EC used a variable rate of glucose infusion to achieve euglycemia (defined as basal glucose concentrations measured prior to the test) while infusing insulin at 1 mU/kg $\cdot$ min^{-1} in calves or 6 mU/ kg $\cdot$ min^{-1} in cows. Insulin and glucose were infused through a jugular catheter. Blood was collected every 5 min, and glucose concentrations were measured using a handheld glucometer. Glucose disposal rate (GDR) was calculated from the glucose infusion rate after euglycemia was achieved. The GDR was converted to S_I by factoring the change in plasma insulin from basal to hyperinsulnemia and plasma glucose at euglycemia. The S_I from the MM and EC were converted to a common index of insulin sensitivity (S_C). Spearman correlation coefficients were calculated between S_I from the MM and EC. In calves the mean S_C was 0.22 ± 0.17 and 0.34 ± 0.21 dL/min $\cdot\mu$U^{-1} $\cdot$mL^{-1} from the MM and EC, respectively. In cows the mean S_C was 0.29 ± 0.25 and 0.42 ± 0.15 dL/min $\cdot\mu$U^{-1} *cdot*mL^{-1} from the MM and EC, respectively. The tests tended to be correlated in calves (r = 0.42) but not in cows (r = -0.08). The MM and EC do not seem to be directly comparable in cattle and should not be interchanged. Both tests are adequate for measuring differences in S_I when evaluating treatments.

Key Words: Minimal Model, Hyperinsulinemic Euglycemic Clamp, Insulin Sensitivity

217 Effects of colostrum feeding time and sex on serum leptin and fatty acid metabolism in newborn Holstein calves. L. J. Driedger*, J. A. Jackson, K. Meek, and S. T. Franklin, *University of Kentucky, Lexington.*

Serum leptin has been shown to be negatively correlated to non-esterified fatty acids (NEFA) in adult Holstein cows. Leptin is also a stimulator of the thermogenic capacity of brown adipose tissue, the main source of body heat production earliest in the baby calfs life. The objectives of this experiment were to measure the effects of feeding or withholding colostrum and sex on serum leptin and fatty acid metabolism in newborn calves. Eighteen Holstein calves were divided into three experimental groups. Group 1 consisted of 6 male calves that were withheld from colostrum for 12 hours after birth (Not Fed = NF). Groups 2 and 3 consisted of 6 male or 6 female calves that were fed colostrum as soon as they could suckle (Fed Male = FM, Fed female=FF). Immediately after birth, all calves were separated from dams to prevent maternal suckling. Calves were weighed and an initial 0 hour blood sample was drawn. Calves from the FM and FF groups were then fed 2.13 L of maternal colostrum. Additional blood samples were drawn at 3, 6, and 12 hours after feeding. Blood samples were drawn from NF calves at 0, 3, 6 and 12 hours after birth. The NF calves were fed 2.84 L of maternal colostrum immediately following the 12-hour blood sample. Blood was analyzed for serum leptin, NEFA, and β-hydroxybutyrate (BHBA). Data were analyzed using the PROC MIXED procedures of SAS. There were no significant effects of colostrum treatment (NF vs. FM) on serum leptin (P=.6708). However, leptin was significantly higher and increased over time for the FF group compared to the FM group at 3, 6, and 12 hours (P<.01). Effects of sex were not significant on NEFA for any time period (P=.7580) when comparing the FM and FF groups. However, NEFA was significantly lower and decreased over time for the FM group compared to the NF group at 3, 6, and 12 hours (P<.01). BHBA concentrations were not different according to sex (FM vs. FF, P=.8099), but were significantly higher for the FM group compared to the NF group at the 12 hour sampling time (P<.0001). Serum leptin appears to be negatively correlated to NEFA in baby calves from 0 to 12 hours after birth.

Key Words: Calves, Leptin, NEFA