counts. Chlorate may be effective in preventing pathogen persistence in feedlot soils at ~6°C temperatures.

777 Effects of maternal nutrition and selenium supply on postnatal organ mass: Evidence for developmental programming in lambs. J. S. Caton*[1], J. J. Reed[1], T. L. Neville[1], K. A. Vonnahme[1], P. P. Borowicz[1], J. B. Taylor[2], D. A. Redmer[1], J. S. Luther[1], C. J. Hammer[1], K. R. Carlin[1], and L. P. Reynolds[1], [1]*Center for Nutrition and Pregnancy, Animal and Range Sciences Department, North Dakota State University*, *Fargo*, [2]*USDA-ARS, U. S. Sheep Experiment Station*, *Dubois, ID*.

To examine effects of maternal nutrient restriction or excess and dietary Se on postnatal organ mass in the lamb, 82 pregnant Rambouillet ewe lambs (52.2 ± 0.8 kg) were allotted randomly to one of 6 treatments in a 3 x 2 factorial design. Groups included plane of nutrition (60% [RES], 100% [CON], and 140% [HIGH] of requirements) and dietary levels of Se (adequate Se [7.4 µg/kg BW] vs. high Se [85 µg/kg BW]; from Se enriched yeast). Selenium treatments were initiated at breeding and nutritional treatments on d 40 of gestation. Pelleted diets were fed once daily (36.5% beet pulp, 22.3% alfalfa meal, 16.2% corn, 18% soybean hulls, and 7.0% soybean meal; 14.4 % CP, 2.63 Mcal ME/kg; DM basis). At parturition, lambs were removed from the ewes before nursing and provided artificial colostrum for the first 20 h and were maintained on common management and diets until necropsy at approximately 5 mo of age. Live BW, hot carcass weight, and dressing percent were not affected ($P > 0.26$). Lamb pancreatic mass (g) was reduced ($P = 0.06$) in RES and HIGH compared with CON, as was blood mass (g and g/kg of empty BW; $P < 0.08$). Mass of the reticulum (g) was also reduced ($P = 0.10$) by in lambs from the RES and HIGH compared with CON ewes. In the lambs, maternal Se supplementation increased ($P < 0.01$) mass (g and g/kg empty BW) of the ovaries, decreased ($P < 0.09$) mass of heart and kidney (g/kg empty BW), and increased ($P = 0.04$) total visceral adiposity compared with adequate Se. Maternal nutrition by Se interactions were observed ($P < 0.06$) for omasum, small intestine, ileum and lungs. These data provide strong evidence for developmental programming of internal organ mass in offspring from pregnant ewes receiving various nutritional levels and supplemental Se.

Key Words: Maternal Nutrition, Selenium, Fetal Programming

778 Effects of maternal nutrition and selenium supply on ewe and lamb performance. T. L. Neville*[1], J. J. Reed[1], K. A. Vonnahme[1], P. P. Borowicz[1], J. B. Taylor[2], D. A. Redmer[1], J. S. Luther[1], C. J. Hammer[1], G. P. Lardy[1], L. P. Reynolds[1], and J. S. Caton[1], [1]*Center for Nutrition and Pregnancy, Animal and Range Sciences Department, North Dakota State University*, *Fargo*, [2]*USDA-ARS, U. S. Sheep Experiment Station*, *Dubois, ID*.

To examine effects of maternal nutrient restriction or excess and dietary Se on ewe and lamb performance, 82 pregnant Rambouillet ewe lambs of equivalent BW (52.2 ± 0.8 kg) and condition score (BCS; 3.0 ± 0.05) were allotted randomly to one of 6 treatments in a 3 × 2 factorial design. Groups included plane of nutrition (60% [RES], 100% [CON], and 140% [HIGH] of requirements for gestating ewes) and dietary levels of Se (adequate Se [7.4 µg/kg BW] vs. high Se [85 µg/kg BW]; from Se enriched yeast). Selenium treatments were initiated at breeding and nutritional treatments on d 40 of gestation. All diets were fed once daily in a complete pelleted form (36.5% beet pulp, 22.3% alfalfa meal, 16.2% corn, 18% soybean hulls, and 7.0% soybean meal; 14.4 % CP, 2.63 Mcal ME/kg; DM basis). At parturition, lambs were removed from the ewes before nursing and provided artificial colostrum for the first 20 h, after which they were fed milk replacer. At parturition, ewe BW and BCS were least ($P < 0.01$) in RES, intermediate in CON, and greatest in HIGH (53.9, 67.3, and 76.5 ± 1.4 kg and 1.60, 2.53, and 3.61 ± 0.10, respectively), as were ewe ADG and efficiency ($P < 0.01$). Ewe BW, BCS, ADG, gain efficiency, and gestation length were not altered by Se supplementation. Gestation length was reduced ($P < 0.01$) in HIGH compared with CON and RES. At birth, lamb BW, curved crown rump length, and heart girth were lower ($P = 0.01$) in RES and HIGH compared with CON. Weaning weight 8 weeks postpartum was less ($P = 0.01$) in lambs from RES ewes compared with those from CON and HIGH. Birth and weaning weight were unaffected by Se supplementation. These data indicate that maternal plane of nutrition but not supplemental Se affects the BW, BCS, and gestation length of the ewes and the birth and weaning weights of the resulting lambs.

Key Words: Birth Weight, Maternal Nutrition, Selenium

779 First-lactation milk production for cows fed control or intensified milk replacer programs as calves. J. K. Drackley*, B. C. Pollard, H. M. Dann, and J. A. Stamey, *University of Illinois*, *Urbana*.

Potential long-term effects of early-life plane of nutrition were quantified in 2 trials. Female Holstein calves housed in individual hutches were fed milk replacers in either conventional limit-fed (C: 22% CP, 20% fat; 1.25% of birth BW) or intensified programs (I: 28% CP, 20% fat). The 2 trials differed only in how I was increased after wk 1. Calves were weaned at 5 wk (C) or 6 wk (I). Calves were housed in groups by treatment from wk 9 to 12, then combined under common group management. Growth results were reported previously (Pollard et al., 2003, J. Dairy Sci. 86(Suppl. 1):174). Calves fed I had greater (P<0.001) ADG to wk 4 (Trial 1: 0.30 vs. 0.71 kg/d; Trial 2: 0.36 vs. 0.72 kg/d for C and I, respectively) and wk 8 (Trial 1: 0.56 vs. 0.69 kg/d, P<0.01; Trial 2: 0.59 vs. 0.67 kg/d, P=0.08). However, because growth slumped around weaning for I calves, BW at wk 12 did not differ (Trial 1: 103.7 vs. 104.2 kg, P=0.93; Trial 2: 103.9 vs. 97.2 kg, P=0.11). Lactation data from the 2 trials were pooled and analyzed using the Mixed procedure (SAS) with a model containing month of calving, age at calving, and lactation length as covariates; diet, trial, and the interaction were fixed effects. Age at first calving differed (P<0.01) between trials (Trial 1=25.9 mo; Trial 2= 24.1 mo) but was not affected by diet. Post-calving BW did not differ between trials or diets (mean 568 kg). A total of 10, 10, 18, and 14 heifers completed lactation records for C and I diets in Trials 1 and 2, respectively. Actual 305-d milk was greater (P<0.01) for I calves (Trial 1: 9,245 vs. 10,577 kg; Trial 2: 8,796 vs. 9,138 kg). Protein yield (305 d) was greater (P<0.001) for I calves but milk fat yield did not differ. Lactation length tended to be greater (P=0.07) for I calves (358 vs, 407 d). Total lactation milk yield was greater (P<0.01) for I calves (Trial 1: 11,232 vs. 12,917 kg; Trial 2: 10,824 vs. 11,243 kg; trial x diet, P=0.08). Intensified early nutrition increased early growth rates but greater BW was not sustained through wk 12; nevertheless, first-lactation milk yield was increased.

Key Words: Calf Nutrition, Lactation, Calves

780 Effect of mineral supplementation with MIN-AD during the transition period on cow health and production performance. J. E. Nocek*[1], R. G. Hinders[2], C. J. Sniffen[3], G. A. Nunnery[4], and M. B. Crombie[4], [1]*Spruce Haven Farm and Research Ctr*, *Auburn, NY*, [2]*Hinders Nutritional Consulting*, *Acampo, CA*, [3]*Fencrest*, *Holderness, NH*, [4]*MIN-AD, Inc.*, *Amarillo, TX*.

The objective of this study was to determine the effect of partial replacement of MgO and sodium bicarbonate with MIN-AD in the ration of early lactation cows on milk yield, composition and health. One hundred and four multiparous cows were group housed pre- and postpartum in separate pens containing approximately 70cows/group. They were assigned to the following treatments based on parity and previous lactation 305ME: Control: Cows received sodium bicarbonate at 1.0% of DM upon calving, MIN-AD: Cows received MIN-AD (MIN-AD, Inc., Amarillo, TX) at 0.5% DM for the entire study. At calving, these cows also received sodium bicarbonate at 0.5% of ration DM. Cows started the experimental period 21d prior to expected calving and remained on treatment for 10 wk during the subsequent lactation. There was no significant effect of MIN-AD on health incidence measured. However, there was a tendency for reduced displaced abomasums (P = 0.16, 7.7 and 1.9%) and clinical milk fever (P=0.15, from 3.8 % and 0%) for cows supplemented with MIN-AD. Group dry matter intakes were similar between treatments during the pre- and postpartum periods. Milk yield was higher (P = 0.001) for cows supplemented with MIN-AD as compared to control cows (42.4 and 44.1 kg/d for control and supplemented respectively). There was no treatment effect on milk fat percentage, yield or protein percentage. Protein yield and MUN were higher (P=0.03 and 0.02 respectively) for cows supplemented with MIN-AD, and lactose was higher (P=0.01) for control cows. Body condition scores were not affected by MIN-AD supplementation. Partial replacement of MgO and sodium bicarbonate with MIN-AD during the transition period did not influence health but increased milk production and protein yield.

Key Words: Dairy cattle, Transition, MIN-AD

781 Effects of twin pregnancy and dry period feeding strategy on milk production, energy balance and metabolic profiles in Holstein cows. N. Silva del Río*, R. R. Grummer, and P. M. Fricke, *University of Wisconsin*, *Madison*.

To evaluate the interaction of pregnancy type [singleton (S) vs. twin (T)], and dry period feeding management [transition diet (NEL=1.54 Mcal/kg) for 3 (3TR) vs. 8 (8TR) wk before expected calving date (ECD)], multiparous (n=39) and primiparous (n=8) Holstein cows were used in a 2x2 factorial randomized complete block design. Our hypothesis was that 8TR would improve metabolic status and lactation performance for T but not S cows. All cows were feed a late lactation diet (NEL=1.58 Mcal/kg) 90 to 60 d before ECD and the same early lactation diet (NEL=1.71Mcal/kg) after calving. At dry-off, cows were randomly assigned to 8TR or a far-off diet (NEL=1.32 Mcal/kg) for 5 wk followed by 3TR. DMI was measured daily, milk components were analyzed weekly, and blood samples were collected weekly from 90 d before ECD to calving. Postpartum, blood was collected from wk 1 to 5, and wk 7 and 10. Liver biopsies were performed about 3 wk before ECD and 1 and 35 d after calving. All data were covariately adjusted and statistically analyzed in a repeated measures design using the MIXED procedure of SAS. The least square means for main effects and their significances are described in the table below. Contrary to our hypothesis, no interaction (P>0.05) of dry period feeding management and pregnancy type was detected either prepartum or postpartum; however, feeding a diet moderate in energy throughout the dry period was associated with increased milk production. Supported by USDA NRI grant number 2002-35204-12351

Table 1.

	Diet		Calf		Diet	Calf
Response Variable	3TR	8TR	S	T	*P*	*P*
Prepartum						
DMI (kg)	11.8	13.3	12.9	12.1	0.03	0.22
EB (Mcal/day)	1.4	4.2	4.7	0.9	0.01	<0.01
BHBA (mg/dL)	5.2	5.9	5.3	5.9	0.02	0.06
NEFA (µEq/L)	198	168	150	216	0.02	<0.01
Liver TG (µg/µg DNA)	1.4	0.9	0.9	1.1	0.01	0.07
Postpartum						
DMI (kg)	21.6	22.1	21.5	22.2	0.5	0.31
3.5% FCM (kg)	43.8	49.2	47.8	45.3	0.03	0.30
EB (Mcal/day)	-2.5	-5.5	-5.8	-2.2	0.02	0.01
BHBA (mg/dL)	6.4	7.8	7.6	6.6	0.09	0.33
NEFA (µEq/L)	393	461	447	406	0.06	0.02
Liver TG (µg/µg DNA)	3.6	3.1	4.1	2.6	0.52	0.04

Key Words: Twinning, Prepartum Diet, Lactation Performance

782 Effect of botanical extracts (Queen of Calves) on the growth, development and weaning age of calves. J. K. Margersion* and R. W. Reynolds, *Massey University*, *Palmerston North, New Zealand*.

This research assessed the effect of feeding botanical extracts (Queen of Calves) with milk on; calf growth, development, feed intake and weaning age. Sixty calves were selected at random and allocated (48 h) according to sex, breed and live weight to one of three treatments; 4 l /h/d of whole milk (M); 4 l/h/d whole milk 4 l, plus 200 g botanical extracts (M+B); 2 l/h/d whole milk, plus 200 g botanical extracts (0.5M+B). Calves offered M+B had significantly higher live weight gain (g/h/d): M; 648^{b}, M+B; 755^{a}, 0.5M+B: 729^{ab} (sem 31.3), hip height (m): M; 1.81^{b}, M+B; 1.83^{a}, 0.5M+B; 1.82^{ab} (0.43) compared with M, there was no difference between calves offered 0.5M+B and M. All calves offered botanical extracts had higher hip width (mm): M; 18.7^{b}, M+B; 19.5^{a}, 0.5M+B; 19.0^{b} (0.17) compared with M. Days to weaning from milk (M; 79.2^{a}, M+B; 70.6^{b}, 0.5M+B; 74.7^{a} (1.97) and weaning from concentrated feed (M; 87.3^{a}, M+B; 79.0^{b}, 0.5M+B; 82.5^{a} (1.10) were significantly lower for calves offered M+B and were not significantly different for calves offered 0.5 M+B with 4 l milk. Concentrated feed intake was not significantly different (kg/h): M; 103.8, M+B; 97.3, 0.5M+B; 110.3 (4.34). Calves offered milk with botanical extracts had significantly higher growth rates, hip height and width, and weaned significantly sooner. Calves offered 2 l/h/d milk with botanical extracts had similar growth rates compared with calves offered 4 l/h/d milk.

Key Words: Calves, Growth, Development

783 Impacts on growth of beef cattle due to long-term copper deficiency are further exacerbated in the presence of high dietary manganese. S. L. Hansen*, L. R. Legleiter, R. S. Fry, K. E. Lloyd, and J. W. Spears, *North Carolina State University*, *Raleigh*.

A study was conducted to evaluate the effects of long-term copper (Cu) deficiency, either alone or in the presence of high manganese (Mn), on the performance of beef calves. Twenty-one Angus calves were born to cows that had been on one of the following treatments for at least 410 days by calving: 1)10 mg Cu/kg DM from tribasic copper chloride in addition to the basal diet (analyzed 7 mg Cu/kg DM; +Cu), 2) no supplemental Cu and 2 mg molybdenum (Mo)/kg DM (-Cu), and 3) no supplemental Cu, 2 mg Mo/kg DM and 500 mg Mn/kg DM from manganese sulfate (-Cu+Mn). After weaning, calves remained on the same treatments as their dams and were group fed by treatment for a period of 33 days before being individually fed via Calan gate feeders through a 136 day growing phase. The average calf age at weaning was 180 days. Liver biopsies taken when calves were approximately 160 days of age indicated that calves fed low-Cu diets were below the threshold for Cu deficiency (7 and 4 mg Cu/kg DM for -Cu and -Cu+Mn, respectively). Copper adequate calves were heavier (237 kg; $P < 0.05$) at weaning than those fed -Cu (199 kg) or -Cu+Mn (186 kg) diets. Daily gains from birth to weaning were greater ($P < 0.01$) for +Cu calves (1.09 kg) than for -Cu (0.88 kg) and -Cu+Mn (0.82 kg) calves. During the growing phase, ADG was not different between +Cu (1.08 kg) and -Cu (1.05 kg) calves, but was lower (0.86 kg; $P < 0.05$) in -Cu+Mn calves. Dry matter intake during the growing phase did not differ among +Cu (7.36 kg) and -Cu (7.08 kg) calves. However, DMI was lower ($P < 0.01$) in -Cu+Mn calves (5.39 kg) when compared to -Cu calves. Feed efficiency during the growing phase did not differ among treatments. Findings from this study indicate that a low-Cu diet fed to calves prior to weaning adversely affects performance. In addition, the presence of high Mn in diets of Cu-deficient calves further exacerbates the effects of low Cu on growth.

Key Words: Cattle, Copper, Manganese

784 Effects of high B-vitamin supplementation on measures of health and performance of veal calves. D. Wood*[1], J. Sowinski[1], and N. Keith[2], [1]*Animix*, *Juneau, WI*, [2]*Keith Associates*, *Springfield, MO*.

An experiment was conducted to determine effects of enhanced B-vitamin fortification on calf health and performance. Auction sourced Holstein bull calves (n = 110; initial BW = 46 kg; ~1 wk of age) were transferred to the facility, and randomly placed into individual raised, slatted veal stalls. All calves were provided starter formula (22% CP and 16% fat) composed of liquid fat, whey, skim milk, & spray dried plasma, and transitioned to a veal finisher (19.5% CP and 17% fat) at ~40 days. Formulas were fortified with a typical B-vitamin containing, dispersible premix. Calves were randomly assigned to receive one of two treatments, 1) Increased B-vitamin fortification: 9 × B1, B2 and B6; 8 X pant. acid, 6X B12, 7× biotin, 3× folic acid, 2× choline and 4× niacin (B-vit; n = 55), 2) no added supplement, only basal formula (Control; n = 55). Individual calf BW was determined on d 11 and d 62 and individual hanging carcass weights were determined at slaughter. Calf ADG from day 11 – 62 did not differ (P = 0.50) among treatments (0.95 and 0.97 kg/d for Control and B-vit.-Fortified, respectively). Calf ADG from day 11 – 143 (market) did not differ (P=0.75). Individual antibiotic treatments day 11 – 63 were reduced from 1.52 / calf in control to 0.63 / calf in B-vit. (P = 0.101). Incidence of feed refusals day 11 – 63 reduced 23% (P = 0.35) and percentage of calves treated was reduced from 41.8% in control to 25.5% in B-vit (P=0.07). Incidence of re-treatment day 11 – 63 was reduced from 29% in control to 12.7% in B-vit (P=0.035). Mortality and culls to 9 weeks was 1.8% B-vit and 5.3% Control. Weeks 10 – 23 reported no diff. in ADG (1.49 and 1.50 kg/d for Control and B-vit, respectively, P=0.93) or feed refusals (P=0.91). 4 calves (7.2%) died of disease in both treatments during week 10 - 23. Individual antibiotic treatments week 10 – 23 were reduced from 1.79 / calf in B-vit to 1.22 in control (P=0.254). No difference was noted in carcass color or confirmation (P=0.36). Under the conditions reported in this study, additional B-vitamin supplementation improved measures of calf health to week 9 but did not improve health parameters week 10 – 23.

Key Words: Calf, B Vitamin, Vitamin

Ruminant Nutrition: Protein and Fiber Digestion

785 Protein requirements of Nellore bulls, steers and heifers in Brazil. P. V. R. Paulino*[1], S. de C. Valadares Filho[1], M. A. Fonseca[1], K. A. Magalhães[1], M. I. Marcondes[1], M A. de Souza[1], E. Detmann[1], R. F. D. Valadares[1], and R. D. Sainz[2], [1]*Universidade Federal de Viçosa*, *Viçosa, MG, Brazil*, [2]*University of California*, *Davis*.

The objective in this trial was to determine the protein requirements of Nellore bulls, steers and heifers, reared under the same experimental conditions. Forty–seven animals were used (16 bulls, 15 steers and 16 heifers), being fed in individual pens for 112 days, and slaughtered at the end of this period. Eleven animals (4 bulls, 3 steers and 4 heifers) were slaughtered at the beginning of the trial, composing the reference group, which was used to estimate the initial body composition of the animals. The remaining animals were randomly assigned to 6 treatments, in a factorial design, 3 × 2 (3 sexual classes and 2 concentrate allowance levels), with four replicates per treatment. Four animals of each sexual class were designated to the maintenance group. The concentrate allowance levels used corresponded to the allowance of 0.6 or 1.2% of the body weight. The diets were formulated to be isoproteic, with corn silage as the source of roughage. The protein content retained in the body was estimated by a regression equation of the logarithm of the body content of protein on the logarithm of the empty body weight (EBW). The net requirements of protein for 1 kg of empty body gain (EBG) were estimated as the derivative of the regression equation described above. The net protein requirements of EBG decreased as the live weighted increased, being greater for the bulls, intermediate for the steers and lower for the heifers. The retained protein (RP) can be estimated by the equations: RP = 14,78 + 175,86 * EBG – 2,95 * RE (bulls), RP = 25,62 + 139,81 * EBG – 7,43 * RE (steers); RP = 18,13 + 177,27 * EBG – 16,57 * RE (heifers). Bulls had higher net requirements of protein for empty body gain in relation to the steers and heifers, being lower for the heifers in relation to the steers, reflecting the differences observed in the body composition among the three sexual classes. The estimated total requirements of crude protein, for finishing of Nellore cattle, were 12.92; 11.14 and 10.08% of the total dry matter of the diet, for bulls, steers and heifers, respectively.

Key Words: Beef Cattle, Zebu, Protein