48th Annual Pacific Northwest Animal Nutrition Conference

October 9-10, 2013
The Coeur d'Alene Resort, Coeur d'Alene, Idaho

Student Abstracts

Effect of an injectable trace mineral on pregnancy rate of virgin heifers when synchronized using the 5 day Co-Synch plus CIDR or 14 day CIDR-PG protocol

C. J. Brasche, J. B. Hall, R. Kasimanikam, and M. E. Drewnoski

This study examined the effect of using a commercially available injectable trace mineral (TMI) on the reproductive performance of virgin heifers. Beef heifers (n = 109) were used to determine the effects of TMI prior to fixed time artificial insemination (AI) on conception to fixed timed AI when one of two synchronization protocols (5 d Co-Synch plus CIDR vs. 14 d CIDR-PG) as well as the effects on pregnancy rate after exposure to a cleanup bull. Thirty-three days prior to AI, heifers were receiving TMI were given Multimin®90 (0.57 mL/45.5 kg of BW). For the 14 d CIDR-PG protocol, a controlled internal drug release device (CIDR) was inserted 33 days prior to insemination and removed 14 days later. Prostaglandin (PG) was injected 16 days after CIDR removal and heifers were artificially inseminated 73 h later. For the 5 d protocol, a CIDR was inserted 7 d prior to AI and an injection of gonadotropin-releasing hormone (GnRH) was given. Five days later the CIDR was removed and a PG injection was given. A second PG injection was given 5.6 h later and heifers were artificial inseminated 55 h after the last PG injection. All heifers received an injection of GnRH concurrently with AI. Conception was determined using ultrasonography at 55 days post AI. There was a tendency for a synchronization protocol by TMI interaction for rate of heifers conceiving to AI ($P = 0.07$) and total pregnant after being exposed to the bull for one estrous cycle ($P < 0.01$). There was no difference in AI conception rate ($P = 0.54$) or overall pregnancy rate ($P = 0.61$) between control and TMI for heifers receiving 5 d protocol. The AI conception rates for the 5 d protocol were 63.0 and 55.6 % for the control and TMI, respectively. Overall pregnancy rates within the 5 d protocol were 75.0 and 74.1 % for control and TMI, respectively. However, for heifers receiving the 14 d protocol there was a tendency for an increase in AI conception rate ($P = 0.06$) and there was an increase in overall pregnancy rate ($P < 0.01$) for heifers receiving TMI compared to the control. Rate of AI conception for the 14 d protocol were 55.6 and 75.0 % for control and TMI, respectively. Overall pregnancy rates were 62.0 and 89.3 % for control and TMI, respectively. This data suggests that use of a TMI in conjunction with the 14 d CIDR-PG protocol may improve pregnancy rates in virgin heifers but appears to have no affect when a 5 d Co-Synch plus CIDR protocol is utilized.

2013 Pacific Northwest Animal Nutrition Conference Proceedings

PRELIMINARY INVESTIGATION TO PREDICT BEEF COW EFFICIENCY BASED ON COW AND CALF PRODUCTION MEASURES.

E.C. Hall* and C.J. Mueller
Eastern Oregon Agricultural Research Station, Oregon State University, Union, Oregon

Traditionally, beef cow production efficiency has been estimated using pounds of weaned calf. Discussions have also revolved around matching cow size with the environment; unfortunately, research is limited in regards to the interaction of cow size, calf growth, and extensive grazing systems. Two beef cow datasets were used to evaluate the potential use of applied cow measures to estimate pre-weaning and post-weaning calf production. The first dataset (SET1), containing 660 spring calving Angus-based crossbred cows over a five year period, was used to evaluate BW at weaning with pre-weaning cow and calf measures. Cow-calf pairs had access to forested grazing allotments from mid-June until mid-October; with weights and BCS obtained at birth, pre-grazing, and weaning. The second dataset (SET2), consisting of 490 spring calving Angus-based crossbred cows, was used to evaluate BW at weaning with calf carcass measures. Individual carcass measures were obtained on both heifer and steer calves finished and harvested in commercial facilities. All birth and weaning BW were adjusted for cow age to a common calf age of 205 d. Pearson correlation coefficients were estimated between SET1 and SET2 production measures with the following indices: 1) actual kg of weaned calf/cow (AWEAN), 2) standardized kg of weaned calf/cow (SWEAN), 3) pre-weaned calf gain/cow (WNGAIN), 4) calf weaning BW as percent of cow BW (CWPBW), and 5) calf weaning MBS as a percent of cow MBS (CWPMBS). Outcomes from SET1 indicate little or no correlation ($r < 0.15$) between prediction indices and either change in BCS during grazing or subsequent calving rate. The AWEAN, SWEAN and WNGAIN indices were weakly correlated ($r = 0.12$ to -0.12; $P \leq 0.05$) with change in cow BW during the grazing season. In addition CWPBW ($r = 0.47$) and CWPMBS ($r = 0.34$) were moderately correlated ($P \leq 0.05$) with 205 d weaning BW. Outcomes from SET2 indicate weak correlations ($r = -0.15$ to 0.00; $P \leq 0.05$) between age at harvest and final yield grade. The AWEAN, SWEAN and WNGAIN were moderately correlated ($r = 0.33$ to 0.56; $P \leq 0.05$) with HCW, but not correlated to carcass marbling scores. These datasets suggest predicting beef cow efficiency based solely on calf crop output is marginal and other unidentified factors may have a greater influence on cow maintenance.

2013 Pacific Northwest Animal Nutrition Conference Proceedings

Effects of feeding Vitamin A, ionophores, and protein on feed intake, milk components, and somatic cell score

K.C. Ramsey*, J. Blickenstaff, C.Y. Tsai, C. M. Scholte, K. Person, S. Clark, M. A. McGuire, and P. Rezamand

Department of Animal Science and Veterinary Science

University of Idaho, Moscow Idaho

Managing dairy cattle during the transition period is a great challenge for dairy industry. During this time period, there is a greater risk of metabolic disorders and infectious diseases, mainly because of decreased feed intake and suppressed immune system. Therefore, dietary factors that could improve feed intake and bolster immune function are critical to the diary industry. An objective of this study was to determine the effect of feeding various amounts of dietary vitamin A, protein, and an ionophore on performance measures and retinoids metabolism. Multiparous Holstein dairy cows (n = 80) were studied from day -35 to +21 relative to expected calving date, in a complete randomized block design with a 2 × 2 × 2 factorial arrangement of treatment, in which cows received vitamin A (0 or 110 IU/kg BW), an ionophore (0 or 400 mg/d per head) and dietary crude protein (12.5% or 16%). Milk samples were obtained at the 1st, 2nd, 3rd milking, and every three days after initial sampling and processed for components and somatic cell count (SCC). Serum samples were collected on days -35, -7, +3, +9, +21 and processed using HPLC for determination of retinol, *13cis* retinoic acid, and *all trans* retinoic acid contents. Weekly feed samples were obtained and analyzed for dry matter. Effects of dietary factors were tested in SAS and significance declared at $P < 0.05$. Preliminary results indicated a protein by vitamin A interaction on milk yield ($P = 0.038$). Also a significant effect for the vitamin A treatment on milk SCC ($P = 0.05$) and a tendency on somatic cell linear score ($0.05 \leq P < 0.1$) was noted. There was no detectable effect by dietary treatments on dry matter intake both pre- and postpartum. Further, there were minor differences in milk components by dietary treatments. However, results indicated an effect of dietary vitamin A on *13cis* retinoic acid in serum ($P = 0.0003$). Data also indicated that dietary protein had an effect on serum vitamin A concentrations ($P = 0.008$) and a protein by vitamin A interaction was detected on serum retinol concentration. Overall, our data indicate that dietary vitamin A and protein significantly affect serum vitamin A concentrations and somatic cell count without compromising performance measures. Further studies are needed to better understand health and performance during the transition period.

2013 Pacific Northwest Animal Nutrition Conference Proceedings

Effect of subcutaneous fat stores on serum phospholipid and nonesterified fatty acid fractions in periparturient dairy cows

C. M. Scholte,* K. C. Ramsey, S. L. Shields, P. Rezamand

Department of Animal and Veterinary Science, University of Idaho, Moscow, Idaho

Lipid mobilization in early lactating dairy cows causes a massive release of fatty acids (FA) into the blood in non-esterified form (NEFA). Large quantities of circulating NEFA may alter the FA profile of various lipid fractions of serum. The objective of this study was to determine the effects of subcutaneous fat stores, as assessed by body condition score (BCS) around the time of calving, and the subsequent lipomobilization during early lactation on FA profile of serum NEFA and PL fractions and on productive performance. Based on BCS, cows were retrospectively split into two groups: over-conditioned (BCS $\geq$ 3.25) and control (BCS $\leq$ 3.0). During this observational study, 22 primiparous and multiparous cows had serum samples obtained at -28, -7, +8, +18, and +28d relative to parturition and analyzed for changes in the FA profile of the NEFA and PL fractions. Data were analyzed as repeated measures by using PROC MIXED of SAS (SAS Institute Inc., Cary, NC) and significance was declared at $P < 0.05$. As expected, over-conditioned cows had greater total plasma NEFA concentrations and decreased daily dry matter intakes pre- and postpartum. Milk yield and composition did not differ between groups. More importantly however, several FA in the NEFA fraction of plasma lipids varied significantly, including Myristoleic acid (C14:1), Palmitic acid (C16:0), Strearic acid (C18:0) and Eicosatrienoic acid (C20:3 N3) by BCS around the time of calving. In the PL fraction, other FA varied significantly by BCS around time of parturition, including Palmitic acid (C16:0), Margaric acid (C17:0), Linoleic acid (C18:2 cis, cis), and Eicosadienoic acid (C20:2). Further investigation is warranted to fully elucidate mechanistic relationship underlying the effects of excess fat stores on early postpartum alteration of FA profile in various fractions of plasma and circulating immune cells, as this may directly affect functionality.

Keyword: lipidmobilization, phospholipid, nonesterifiend fatty acid, dairy cow

Effects of Urea in a Progesterone Environment on Uterine Response to Interferon-tau

J. A. Spencer[1*], K. Austin[2], K. G. Carnahan[1], A. Ahmadzadeh[1]
Department of Animal and Veterinary Science, University of Idaho, Moscow 83843, USA[1].
Department of Animal Science, University of Wyoming, Laramie, WY 82071, USA[2].
Grant # 2008-35203-04505

High blood and uterine urea concentrations, associated with high dietary protein, can reduce fertility in dairy cows. In a previous *in vitro* study using steroid free culture, urea did not affect bovine endometrial (**BEND**) cell expression of Mx1 and ISG-15 in response to the ruminant maternal recognition protein interferon-tau (**IFNτ**). However, uterine protein secretions are altered in response to IFNτ in the presence of progesterone (**P_4**). Therefore, the objective of the current study was to determine the direct effects of urea on protein expression of the endometrial cells of the bovine uteri in response to IFNτ in the presence of P_4. Using BEND cells as a model, the effects of urea on the production of two IFNτ stimulated proteins, ISG-15 and Mx1, were examined. Bovine endometrial cells were grown to 80% confluency and further incubated for additional 24 h in culture media containing P_4 ($10^{-7}M$). Cells (90% confluent) were then treated with urea at final concentrations of 0, 5, 7.5, or 10 mM urea and subsequently, challenged with 0 or 10,000 antiviral units of recombinant IFNτ and incubated for an additional 24 h. Once harvested, BEND cells were lysed and the cell supernatant was analyzed and quantified for Mx1 and ISG-15, using SDS-PAGE and Western Immunoblotting protocols. Based on optical density, regardless of urea treatment, IFNτ increased ($P < 0.01$) Mx1 and ISG-15 by 11 and 4 fold, respectively. There was no effect of any urea treatment or urea by IFNτ interaction on Mx1 and ISG-15 production after 24 h (ISG-15 $P = 0.7$; Mx1 P = 0.4) of culture. These results show that there is no disruption of IFNτ stimulated Mx1 or ISG-15 production, when BEND cells are exposed to varying concentrations of urea in the presence of P_4 in vitro.

Key Words: urea, interferon, bovine endometrial cells

Optimizing Nutritional and Pasture Management to Improve Beef Sustainability

Robin R. White[1,*], Michael Brady[2], Judith L. Capper[3] and Kristen A. Johnson[1]
Department of Animal Sciences[1], School of Economic Sciences[2] Washington State University, Pullman WA; Livestock Sustainability Consulting,[3] Bozeman MT

Trends in global population, meat demand and resource availability support the need to maintain and improve U.S. beef production sustainability. Improved efficiency can positively impact the three pillars of sustainability: environmental impact (EI), economic viability and social acceptability. Specific nutritional and pasture management practices to improve sustainability have not yet been identified. At the same time there is a need to provide decision support tools for producers to use to identify management opportunities. The objective of this study was to develop, and evaluate a model that optimizes nutritional and pasture management of U.S. beef operations to minimize EI in an economically viable and socially acceptable manner.

An optimization framework was built by integrating a whole-system EI model, a production cost simulator, a pasture model and a regression estimating consumer willingness to pay (WTP) for specialty beef products. Diet and pasture management were adjusted to minimize cradle-to-farmgate EI for a target (100,000 kg) production of hot carcass weight beef subject to biological, economic and practical constraints. Constraints ensured nutrient requirements of cattle were met using realistic feedstuffs, and diet cost increases from minimizing EI were off-set by WTP. The WTP constraint ensured the economic viability of the system. If WTP increased, the system was assumed to be socially acceptable. Least-cost management was used as a baseline. Single- and multi-objective optimizations were conducted minimizing land use, water use and/or greenhouse gas (GHG) emissions from the baseline. Sensitivity analysis was conducted to assess the responsiveness of the output to changes in WTP. Outputs were compared to previously published estimates of beef EI to assess model accuracy. Model usefulness was demonstrated by a scenario assessing the impact of altered precipitation patterns on potential opportunities to improve EI of beef produced in mixed-grass pastures in the Pacific Northwest. Pasture management was simulated using current precipitation patterns for Washington, Oregon and Idaho and predicted state-specific changes in precipitation (U.S. Global Change Research Program, 2009).

When examined individually, GHG emissions, land use and water use could be minimized by 3%, 7% and 6% compared to the baseline. With simultaneous minimization, a 5% increase in diet cost resulted in 2% reductions in land use, water use and GHG emissions. Scenarios minimizing GHG included use of irrigated or intensively-managed (rotated, irrigated and fertilized) pasture. Minimizing land use resulted in diets based on alfalfa hay and intensively managed pasture. Fertilized pasture and intensively-managed pasture were used when water use was minimized. Feedlot diets did not change under any modeled scenario, indicating minimal opportunity to further minimize EI. Sensitivity analysis showed dietary management changes were highly responsive to changes in WTP, suggesting a range of WTP values should be used in decision making. Modeled outputs agreed with previous estimates of beef EI supporting the model's validity. The adjusted precipitation scenario showed the model's sensitivity to weather changes. Altered precipitation reduced opportunity to improve EI and the model suggested significant alterations in pasture management would be needed compared to the baseline scenario. The model can be used to examine management strategies to assist livestock producers develop adaptive management strategies in the face of climate variability.

2013 Pacific Northwest Animal Nutrition Conference Proceedings