Beef Species Symposium: Nutrient Requirements of the Beef Female in Extensive Grazing Systems—Considerations for Revising the Beef NRC

437 Difficulties associated with predicting forage intake by grazing beef cows. S. A. Gunter*[1], D. B. Faulkner[2], A. M. Meyer[3], E. J. Scholljegerdes[4], J. E. Sprinkle[5], S. A. Soto-Navarro[4], and S. W. Coleman[6], [1]*USDA-ARS, Woodward, OK,* [2]*University of Arizona, Oro Valley,* [3]*University of Wyoming, Laramie,* [4]*New Mexico State University, Las Cruces,* [5]*University of Arizona, Payson,* [6]*USDA-ARS, El Reno, OK.*

The current NRC model is based on a single equation that relates DMI to metabolic size and net energy density of the diet and was a significant improvement over previous models. However, observed DMI by grazing animals can be conceptualized by a function that includes animal demand, largely determined by metabolic or linear size, physiological state, genetics, or any combination. Forage DMI is really modified by its nutritive value and balance, herbage mass and structure, locomotion, climate, profitability of bites, the interaction with genetics, and level and type of supplementation. Even in the database used to generate the current NRC equation, DMI by cows is poorly predicted at the extremes. In fact, across the range of actual DMI, predicted DMI is rather flat indicating an insensitivity so further refinement of the model is needed. Also, it may be necessary to construct multiple models designed for various rangeland and pasture types. We would suggest that future models be based on multiple equations including functions for physiological state, previous plane of nutrition, animal suitability to the environment, and activity to modify the predicted DMI. Further, the model could possibly account for imbalances of protein to energy, particularly as it relates to ruminal function, and herbage distribution and accessibility as it influences grazing behavior and selectivity. The inclusion of some of these functions may render the model inputs too complex for many users, hence models must be evaluated for complexity as well as how well the model fits under multiple situations. Further, the issue of how reference data was collected (pen vs. pasture) and how the methods or constraints influence DMI must be evaluated. For instance, if DMI is greater under grazing, is it because of greater metabolic demand due to activity and climatic conditions, or to differences in direct measurement of DMI compared with indirect methods (e.g., internal and external markers). Overall, the new NRC model needs to be more robust in its ability to account for the wide variation in the environment, dietary characteristics, and metabolic demands.

Key Words: cow, grazing, intake

438 How well does the current metabolizable protein system account for protein supply and demand of beef females within extensive western grazing systems? R. C. Waterman*[1], J. S. Caton[2], and C. A. Loest[3], [1]*USDA-Agricultural Research Service, Fort Keogh LARRL, Miles City, MT,* [2]*North Dakota State University, Department of Animal Sciences, Fargo,* [3]*New Mexico State University, Department of Animal and Range Sciences, Las Cruces.*

Extensive western beef livestock production systems within the Southern and Northern Plains and Pacific West combined represent 60% (approximately 17.5 million) of total beef cows in the United States. The beef NRC is an important tool and excellent resource for both professionals and producers to use when implementing feeding practices and nutritional programs within these various production systems. Objectives of this symposium paper are to identify areas within the current beef NRC that could be refined so that future beef NRC models would have greater precision predicting protein supply and demand for beef cattle production within extensive western grazing systems. In western systems, a management protocol often implemented is strategic supplementation which may consist of supplying a prorated bolus dose of protein. An important addition to the current beef NRC model would be to allow users to describe supplement composition, and amount and frequency in which supplement is delivered. Beef NRC models would then need to be modified to account for N recycling that occurs throughout a supplementation interval and the impact that this would have on microbial efficiency and microbial protein supply. The beef NRC should also consider the role of ruminal and postruminal supply and demand of specific limiting amino acids. Additional considerations should include the partitioning effects of nutrients under different physiological production stages (e.g., lactation, pregnancy, and during periods of BW loss) and the role of metabolic modifiers or additives. Metabolic modifiers or additives can greatly influence partitioning of protein (i.e., amino acids) and redirect nutrients for different physiological needs. Our intention is that information provided by this symposium will aid in the revision of the beef NRC by providing supporting material for changes and identifying gaps in existing scientific literature where future research is needed to enhance the predictive precision and application of the beef NRC models.

Key Words: amino acid, ammonia, cow

439 Potential limitations of NRC in predicting energetic requirements of beef females within western U.S. grazing systems. M. K. Petersen*[1], C. Mueller[2], J. T. Mulliniks[3], A. J. Roberts[1], and T. Del Curto[2], [1]*USDA-ARS Ft Keogh Livestock & Range Research Laboratory, Miles City, MT,* [2]*OSU-Eastern Oregon Agricultural Research Center–Union Station, Union,* [3]*University of Tennessee, Knoxville.*

Assessment of cow energy balance and efficiency in extensive grazing settings have occurred on a nominal basis over short intervals and have not been used to model lifetime energy utilization (output Mcal/intake Mcal = lifetime energetic efficiency). Solis et al. (1988) demonstrated in pen-fed cows, differences ($P < 0.01$) in efficiency of weight change ranging from 135 to 58 g/Mcal ME intake. Furthermore, variation in efficiency of ME use for tissue gain or loss from 80 to 36%. Energy costs for maintenance, tissue accretion and mobilization were lower in some breeds. The most efficient may reflect the potential for cattle that fit semi-arid grazing environments with low input management. Successful range cattle are likely the result of natural selection for efficiency. Animals exposed to a variety of stressors may continually adapt so energy expenditure is reduced. Critical factors comprising cow lifetime achievement including reproductive success, disease resistance, and calf weaning weight maybe driven by cow caloric utilization in energy limiting environments. Therefore, ME adjustments for adapted cattle within these landscapes with seasonal BW changes can alter seasonal NEm requirements. Other than growth of replacement heifers, most retained energy is associated with fat storage. Evaluation of energy reserves have been implemented using BCS systems. Estimates of total and composition of BW change associated with plus and minus 1 BCS have been reviewed in the current NRC; depending on BW, breed, and maturity. The overall efficiencies associated with BCS changes are not only affected by composition of BW change, but partial efficiencies associated with tissues utilizing available energy and protein sources and the history of recent gain or loss. Herd analysis questions as to whether NRC BCS descriptions accurately represent NEm requirements of adapted females utilizing western rangelands. A more complete understanding of greater productivity in the field than the current model proposes will help direct future research and inform models to simulate energetic accountability and subsequent female performance.

Key Words: energy requirement, NRC, beef cow