

Alpharma Beef Cattle Nutrition Symposium: Enhancing Beef Production Efficiency with New Knowledge and Technologies: Building the Bridges for Future Collaboration

691 Implications of nutritional management for beef cow/calf systems. R. N. Funston*, *University of Nebraska, West Central Research and Extension Center, North Platte.*

The beef cattle industry relies on the utilization of high forage diets to maintain the cow herd, develop replacement females, and stocker operations. Forage quantity and quality fluctuate with season and environmental conditions. Depending on the class and physiological state of the animal, a grazed forage diet may not always meet nutritional requirements resulting in low ADG or weight loss if supplemental nutrients are not provided. It is important to understand the consequences of such weight loss and the economics of providing supplementation to the beef production system. Periods of nutrient restriction can actually result in compensatory gain once dietary conditions improve and may be of less impact in breeding animals where actual weight is not as important as animals destined for the feedlot provided reproductive efficiency is not compromised. A rapidly evolving body of literature is also demonstrating effects on subsequent offspring developing in a restricted environment in utero. Maternal stimuli or an insult during a critical period of fetal development having long-term implications for the offspring is the concept of fetal programming. In recent studies at the University of Nebraska, calf birth weights were unaffected while calf weaning weights were greater from cows gestated on dormant winter range receiving protein supplementation during late gestation compared with non-supplemented cows. Subsequent steer carcass weights and quality grades were also improved in calves born to supplemented dams and more heifers from supplemented dams were pubertal before breeding and had greater pregnancy rates. This body of research provides compelling evidence of a fetal programming response to maternal nutrition in beef cattle. Future competitiveness of the beef industry will continue to be dependent on the utilization of high forage diets to meet the majority of nutrient requirements. Consequences of nutrient restriction must be considered not only on individual animal performance but also the developing fetus.

Key words: beef cattle, fetal programming, nutrition

692 Altering the ruminal microbiome and its potential impact on animal nutrition and performance. S. L. Lodge-Ivey*, *New Mexico State University, Las Cruces.*

This presentation will address current advancements in rumen biochemistry and how these advancements may need to be dealt with in current paradigms. How these interactions within rumen microbiology, nutrition or metabolism may be understood and how future research may account for this additional source of variation. Characterization of the rumen microbial communities may eventually lead to enhanced production efficiency of grazing animals. Conventional culture-based methods of enumerating rumen microorganism are being replaced by culture independent methods that rely on analysis of nucleic acids extracted from ruminal samples. For example, sampling location within the rumen, liquid versus particulate fraction and handling techniques are all areas of consideration when collecting ruminal samples for analysis with DNA- and RNA-based techniques. Application of modern tools has modified and altered how rumen microbial diversity is measured. The rumen microbiome represents a huge resource with great potential. The future of rumen microbiology research is depen-

dent upon the application of molecular research technologies. There is a need to apply modern technologies to improve production efficiency of ruminants. The goal of this presentation is to identify areas of current research within the field of rumen microbiology and how research nutritionists, consultants and other disciplines can develop partnerships for interactions of multidisciplinary, integrated research approaches to address large novel projects being requested currently by granting agencies.

Key words: rumen microbiology, modern techniques, multidisciplinary interactions

693 Nutrition and the genome. H. L. Neibergs*, *Washington State University, Pullman.*

It has long been appreciated that animals fed the same diet may perform differently. This is due to the ability of nutrients to interact with and affect molecular pathways that result in differences in weight gain, production performance or disease resistance. To understand these effects, studies are being undertaken to discover how the differential expression and function of genes occurs with different diets. These studies are exploiting new technologies, genomic resources and analyses that have recently become available for domestic animals. Nutrigenomics and nutrigenetics incorporate these research approaches to optimize health by looking beyond the diet to understand the effects of food at the genetic and epigenetic levels. Nutrigenomics is focused on the effects of diet on health through an understanding of how bioactive chemicals in foods and supplements alter gene expression or the structure of an animal's genome. Nutrigenetics focuses on how the genetic composition (genetic variation) of an animal influences their response to a given diet. Results from these studies will aid in formulating nutritious efficient diets that may be optimized for animals based on their genomic underpinnings. Nutrigenomics and nutrigenetics unite many fields: nutrition, bioinformatics, molecular biology, genomics, functional genomics, epidemiology and epigenomics. The use of multi-disciplinary tools from these fields promises new opportunities to investigate the complex interactions of the genome and an animals diet. Through these new approaches, the partnerships of the genome and nutrition will be revealed resulting in improved efficiency of diets, enhanced sustainability of animals as a protein source and improved methods for preventing illnesses.

Key words: nutrigenomics, nutrigenetics

694 Impacts of health status and disease prevention with nutrition and performance of beef cattle. B. P. Holland*¹ and L. O. Burciaga-Robles², ¹*Department of Animal and Range Sciences, South Dakota State University, Brookings,* ²*Feedlot Health Management Services Ltd., Okotoks, Alberta, Canada.*

Research in the health of growing and finishing cattle by nutritionists has focused primarily on the interaction of diet, management, and incidence of BRD, and the effects of clinical BRD on subsequent animal performance. Veterinary research has provided a wide array of vaccines, combined with antimicrobials and health management protocols for disease prevention and intervention. While some strategies have

been shown to reduce morbidity and improve performance on an individual lot basis, overall incidence of BRD has increased over time. Management strategies can be employed to minimize the effects of disease on carcass characteristics and profitability. However, diagnosis of disease is subjective and inconsistent, requiring that these strategies be applied to diverse populations with limited discrimination. Recent advances in technology can help researchers understand the metabolic status of animals in healthy and diseased states and the impact of disease and the immune response on nutrient requirements. Results from proteomic methods have cast doubts on traditional experimental models of stress-induced immunosuppression. Data such as these can be used to more accurately create experimental models for studying animal health. In addition, definitions of illness based on biochemical measures can be created so that health responses to treatment can be assessed more accurately and more targeted management can be imposed. Ongoing research is being conducted to determine impacts of prenatal nutrition and lifetime management strategies on animal reproduction, growth, and carcass traits. Measures of health and immune responses should be included in such research to better understand nutrition and epigenetic effects on disease susceptibility and create more inclusive lifetime management systems. Discoveries made using biochemical methods should be incorporated into practical tools so that illness can be prevented, reducing the use of antimicrobials and the subsequent impacts of the immune response on beef production. This paper will review interactions of health and nutrition in beef cattle and propose considerations for future research.

Key words: beef cattle, health, growth

695 Interactions with beef cattle nutrition and metabolism: Developing an integrated across discipline approach to research; building the bridges for future collaboration, summary. D. L. Boss*, *Montana State University, Bozeman.*

As animal science disciplines embark on future research, each discipline is finding and understanding interactions that affect more than one traditional area of training and research. Alpha Beef Cattle Nutrition symposium proposes to address reviews of current and potentially new interactions between beef cattle nutrition and other major animal science disciplines. Grant opportunities are becoming larger and need to include multidisciplinary approaches to solve intricate systems biology research questions. Granting agencies are requesting applications that address an integrated approach. Synergistic collaboration of interdisciplinary team approach to research and outreach allows new collaborative teams to address issues or questions that are vital to stakeholder interests. As research and industry beef cattle nutritionists develop programs for the next 10 to 20 years, these interactions will need to be addressed in design and implementation of new novel nutrition research. In this symposium, experts in several areas discuss and identify future areas for multidisciplinary interaction and development of integrated research programs to address complex and novel areas of investigation to help in the process of building the bridges for future collaboration. By crossing disciplines to integrate research programs, an increased allocation of resources can be achieved and integrated approaches can assist with large scale biological questions. Current advancements in ruminal biochemistry need to be placed in context within existing paradigms of conventional nutritional research. Genomics and endocrinology as influenced by nutrition will address interactions as well as emerging technologies and techniques to beef cattle nutrition. Past, present and future management decisions and their impacts upon beef cattle nutrition such as fetal programming and disease prevention and intervention will be investigated through across discipline research discussions.

Key words: beef cattle nutrition, integrated across discipline