DIVISION OF AGRICULTURE
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Beef Cattle Research Update

United States Department of Agriculture, University of Arkansas, and County Governments Cooperating

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Importance of Animals in Agricultural Sustainability and Food Security

(Reynolds, L. P. et al., North Dakota State University, American Society of Animal Science, University of Kentucky and Baylor College of Medicine)
The Journal of Nutrition: doi:10.3945/jn.115.212-217

A conservative projection shows the world's population growing by 32 percent (to 9.5 billion) by 2050 and 53 percent (to 11 billion) by 2100 compared with its current level of 7.2 billion. Because most arable land worldwide is already in use and water and energy also are limiting, increased production of food will require a substantial increase in efficiency.

- Animal products are an important source of high-quality, balanced, and highly bioavailable protein and numerous critical micronutrients, including iron, zinc and vitamins B-12 and A, many of which are deficient in large portions of the world's population.
- Global demand for animal products is almost certain to continue to increase dramatically. The drivers of the increased demand for animal products include not only population growth but also increased affluence, especially in the developing world, where most of the increase in population will occur.
- Farm animals are critical to a sustainable agricultural system, especially for smallholders who comprise most of the world's farmers. Farm animals contribute not only a source of high-quality food that improves nutritional status but also additional resources such as manure for fertilizer, on-farm power and other by-products and, in addition, provide economic diversification and risk distribution. Moreover, increased efficiencies in the past several decades through genetic selection and improved management technologies have saved a large amount of resources, including water and land, and have substantially reduced the carbon footprint of animal production.
- Ruminants, such as buffalo, cattle, goats and sheep, efficiently convert the forages from grasslands into high-quality animal products, and grazing also can promote the health and biodiversity of grasslands if managed appropriately.

Sustainable farm animal production will also require a more complete understanding of their impact on the environment. Solving the problems and overcoming the obstacles to sustainable food security, although daunting, are not options, because food security is critical not only to national security but also to global stability. Feeding the world's rapidly expanding population can therefore rightly be viewed as the main global challenge of the 21st century. Animals will play an important role in meeting this challenge.

Cow-Calf Reproductive, Genetic and Nutritional Management to Improve the Sustainability of Whole Beef Production Systems

(White, R. R. et al., Washington State University and Livestock Sustainability Consultancy, Bozeman, Montana)
J. Anim. Sci. 2015. 93:3197-3211

Optimizing efficiency in the cow-calf sector is an important step toward improving beef sustainability. The objective of the study was to use a model to identify the relative roles of reproductive, genetic and nutritional management in minimizing beef production systems' environmental impact in an economically viable, socially acceptable manner. An economic and environmental diet optimizer was used to identify ideal nutritional management of beef production systems varying in genetic and reproductive technology use. Eight management scenarios were compared to a least cost baseline: average U.S. production practices, average U.S. production practices with variable nutritional management, twinning cattle, early weaning, sire selection by EPD using either on-farm bulls or AI, decreasing the calving window or selecting bulls by EPD and reducing the calving window.

Diets to minimize land use, water use and/or greenhouse gas emissions were optimized under each scenario. Increases in diet cost attributable to reducing environmental impact were constrained to less than stakeholder willingness to pay for improved efficiency and reduced environmental impact.

- The average U.S. production practices with variable nutritional management scenario, which assessed opportunities to improve sustainability by altering nutritional management alone, resulted in a simultaneous 1.5 percent reduction in land use, water use and GHG emissions.
- The decreasing the calving window scenario improved calf uniformity and simultaneously decreased land use, water use and greenhouse gas emissions by 3.2 percent.
- Twinning resulted in a 9.2 percent reduction in the three environmental impact metrics – land use, water use and greenhouse gas emissions.
- The early weaning scenario allowed for an 8.5 percent reduction in the three metrics – land use, water use and greenhouse gas emissions.
- The sire selection by EPD–AI scenario resulted in an 11.1 percent reduction, which was comparable to the 11.3 percent reduction achieved by sire selection by EPD–on-farm bulls in the three metrics – land use, water use and greenhouse gas emissions.
- Improving genetic selection by using AI or by purchasing on-farm bulls based on their superior EPD demonstrated clear opportunity to improve sustainability.
- When genetic and reproductive technologies were adopted, up to a 12.4 percent reduction in environmental impact was achievable.

Using EPD to select bulls, decreasing the calving window and optimizing nutritional management resulted in a 14.5 percent reduction in land use, water use and greenhouse gas emissions from the beef production system.

Determination of Value of Bovine Respiratory Disease Control Using a Remote Early Disease Identification System Compared With Conventional Methods of Metaphylaxis and Visual Observations

(White, B. J. et al., Precision Animal Solutions, Manhattan and Kansas State University)
J. Anim. Sci. 2015. 93:4115-4122

Mitigation of the deleterious effects of bovine respiratory disease (BRD) is an important issue in the cattle industry. Conventional management of calves at high risk for BRD often includes mass treatment with antimicrobials at arrival followed by visual observation for individual clinical cases. These methods have proven effective; however, control program efficacy is influenced by the accuracy of visual observation. A remote early disease identification system has been described that monitors cattle behavior to identify potential BRD cases. The objective of this research was to compare health and performance outcomes using either traditional BRD control (visual observation and metaphylaxis) or remote early disease identification during a 60-day post arrival phase in high-risk beef calves.

In each replicate, a single load of calves was randomly allocated to receive either conventional management or remote early disease identification as the method for BRD control. Cattle were monitored with each diagnostic method for the first 30 days on feed, and performance variables were collected until approximately 60 days after arrival.

- Statistical differences were not identified in average daily gain or health (morbidity, first treatment success and mortality risk) among the treatment groups.
- Calves in the remote early disease identification pens had a lower average number of days on feed at first treatment (9.1 days) compared with conventional management pens (15.8 days).
- There were no differences in risk of BRD treatment, and remote early disease identification calves were not administered antimicrobials at arrival. Therefore, remote early disease identification calves had a lower average number of doses of antimicrobials per calf (0.75 doses) compared with conventional management calves (1.67 doses).

In this trial, the remote early disease identification system was comparable to conventional management with the potential advantages of earlier BRD diagnosis and decreased use of antimicrobials. Further research should be performed to evaluate the longer-term impacts of the two systems.

Producer Perceptions of the Importance of Challenges Currently Facing the United States Grass-Finished Beef Industry

(Sitienei, I. et al., Louisiana State University)
The Professional Animal Scientist 31(2015):315-323

Consumer interest in grass-finished beef in the United States has risen in recent years, motivating farmers to increase grass-finished beef production. A survey was conducted to determine perceptions among United States grass-finished beef producers of important challenges facing the industry.

- Of the five United States regions specified, 30 percent of our respondents were located in the Midwest, which represented the highest percentage of all regions.
- The Southwest was the least represented with 15 percent of the responses.
- Seventy percent of respondents held four-year college degrees, and the average age was 55 years.

Using categorical responses ranging from 1 = strongly disagree to 5 = strongly agree, four items were selected by respondents as the most important challenges facing grass-finished beef producers.

- Shortage of processors, lack of a clear marketing system, pasture-management problems and the long period of time required to get animals to the desired market weight had means of 3.77, 3.72, 3.71 and 3.67, respectively. The modal response for each of these four items was "strongly agree."
- Farmer demographic and farm characteristics were found to influence producers' perceptions of the importance of each of the challenges to the grass-finished beef industry.
- Shortage of processors and lack of a clear marketing system are institutional in nature and thus call for institutional solutions developed by the industry and supported by integrated research and extension efforts by agricultural economists and animal scientists.
- Research and extension efforts are needed for pasture-management problems and the long period of time required to get animals to the desired market weight.

Integrated efforts from industry, government and research and extension institutions are needed to address these challenges.

Supplemental Trace Minerals (Zinc, Copper and Manganese) as Sulfates, Organic Amino Acid Complexes or Hydroxy Trace-Mineral Sources for Shipping-Stressed Calves

(Ryan, A.W. et al., University of Arkansas and Micronutrients, Indianapolis)
The Professional Animal Scientist 31(2015):333-341

Crossbred calves (n = 350; average body weight = 529 pounds) were obtained from regional livestock auctions. Calves were stratified by body weight and arrival sex into one of eight 0.95-acre pens (10 to 12 calves per pen). Pens were assigned randomly to one of three treatments consisting of supplemental Zn (360 mg/d), Mn (200 mg/d) and Cu (125 mg/d) from inorganic (zinc sulfate, manganese sulfate and copper sulfate; n = 2 pens per block), organic (zinc amino acid complex, manganese amino acid complex and copper amino acid complex; Availa-4, Zinpro Corp., Eden Prairie, Minnesota; n = 3 pens per block), and hydroxy (IntelliBond Z, IntelliBond C and IntelliBond M; Micronutrients, Indianapolis, Indiana; n = 3 pens per

block) sources. During the 42- to 45-day backgrounding period, calves had *ad libitum* access to bermudagrass hay and were fed corn and dried distillers grain-based supplements that served as carrier for the treatments.

- After removal of data for chronic (n = 6) and deceased (n = 1) calves, trace-mineral source had no effect on final or intermediate body weight or average dairy gain.
- With all data included in the analysis, dietary treatments had no effect on the number treated once, twice or three times for bovine respiratory disease or on the number of calves classified as chronic.

Based on these results, trace-mineral source had no effect on total body weight gain, average dairy gain or morbidity during the receiving phase in shipping-stressed cattle.

Evaluating the Effects of Late-Gestation Supplementation on Timed–Artificial Insemination Pregnancy Rates and Body Composition in Beef Cattle

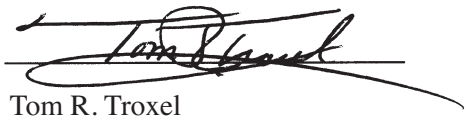
(Walker, R. S. et al, Louisiana State University)
The Professional Animal Scientist 31(2015):255-263

Nonlactating Angus cross beef cows were used to evaluate pregnancy rates and postpartum performance following late-gestation liquid protein or dried distillers grains supplementation. In Exp. 1, 166 multiparous cows were stratified by body weight, body condition score, age and pregnancy status to receive a free-choice liquid-protein or dried distillers grains supplement fed to be isonitrogenous for 77 days during late gestation. In Exp. 2, 53 nulliparous and 36 primiparous cows were stratified similar to Exp. 1 and fed dried distillers grains at maintenance or 1.2 times maintenance energy requirements for 44 days during late gestation. Body weight and body condition score were measured at initial supplementation, calving (except body weight), timed AI and weaning to determine body weight and body condition score change. Cows were sorted into three age groups (Exp. 1) and evaluated for body weight and body condition score change at weaning. All females were synchronized with a 7-day CO-Synch plus controlled intravaginal drug-release protocol with 72 hours of timed AI.

- In Exp. 1, cows fed dried distillers grains had greater body weight change at timed AI and weaning and greater body condition score change at calving compared with cows fed liquid protein.
- Cows that were 3 and 4 years old had the greatest body weight and body condition score change at weaning.
- In Exp. 2, there was no treatment effect on body weight or body condition score change.
- Timed-AI pregnancy rates were similar across treatments for both experiments.

It seems that energy supplementation during late gestation has a greater effect on subsequent body condition scores and body weight change compared with protein supplementation. Late-gestation supplementation of dried distillers grains maintained a positive body weight and body condition score change from initial supplementation to subsequent timed AI and weaning and could have more of an effect on body weight growth and condition the following production cycle in younger growing females; however, further research is needed to understand the effect of late-gestation supplementation on subsequent-year calving and breeding performance.

Late-gestation supplementation with dried distillers grains had positive effects on animal performance, with the greatest effect in the younger females.



Tom R. Troxel
Professor and Associate Department
Head - Animal Science