Symposium: ALPHARMA Beef Cattle Nutrition and Beef Species Joint Symposium: Producing Quality Beef in a Bio-Based Economy

146 ASAS Centennial Presentation: Development and current issues of a corn-based beef industry. L. R. Corah*, *Certified Angus Beef LLC*, *Wooster, OH*.

The development of a beef industry, heavily dependent on corn utilization, began to occur in the 1940s. Started as a means to add value to the grain while improving consumer acceptance of beef, corn has become an integral part of beef production. Developments in the 21st Century—including unprecedented cattle prices, changes in beef demand, BSE, surge in energy costs, pricing differentiation of cattle prices based on quality, and industry consolidation—have dramatically changed the price of corn and cost of beef production. The future of the beef industry will be dependent on our ability to continue producing high-quality beef for a global market through effective use of genetics, new technologies, and economic management strategies.

Key Words: Corn, Feedlot, Beef Quality

147 Feeding strategies to reduce corn use. R. H. Pritchard*[1], D. D. Loy[2], and D. L. Boggs[3], [1]*South Dakota State University*, *Brookings*, [2]*Iowa State University*, *Ames*, [3]*Kansas State University*, *Manhattan*.

The equilibrium among industries competing for corn grain has been disturbed by the dramatic increase in demand for corn use in ethanol production. The current situation differs from previous episodes of high corn prices in that there will be a long term increase in corn usage rather than a short term decrease in corn supply. This will alter cropping plans and reduce access to alternative grains. Biofuels development will increase competition for fats and oils, high fiber feeds, and the amount, form, and cost of ethanol by-products available. Having alternative feedstocks more available to substitute for corn in finishing diets will likely be the exception rather than the norm in many situations. These alternatives will often contain less energy than corn and limitations may exist on dietary substitution levels. Corn is substituted for roughage in finishing diets to increase ADG and to reduce feed/gain. In doing so, the corn per unit of live weight gain (LWG) increases. We can increase final diet roughage from <10% to levels of 20% or 30%, and achieve high growth rates and produce high Quality Grade beef. This requires access to a roughage source and imposes logistical challenges to larger capacity feedlots where most cattle are fed. We can reduce the corn/LWG by 8 to 10% by switching from rolled corn to steam flaked corn. Other potential savings in corn/LWG can be found in managing grain processing x roughage source × roughage level interactions. In older cattle (> 18 mo) reducing the targeted ribfat endpoint at harvest from the current 1.5 cm to 1.0 cm will greatly reduce corn use per unit of retail product; but would be less effective in younger cattle. While implants cause increased intake and final BW, they along with other technologies, effectively reduce corn/LWG. The most dramatic effects in reducing corn usage will come from extensive cattle production systems that increase the amount of growth occurring outside the feedlot. This will likely coincide with a change in the genetics and phenotype of cattle as well as a reduction in total beef cow numbers.

Key Words: Beef, Feeding, Corn

148 Environmental considerations of feeding bio-fuel co-products. N. A. Cole*[1], M. S. Brown[2], and J. C. MacDonald[3], [1]*USDA-ARS-CPRL*, *Bushland, TX*, [2]*West Texas A&M University*, *Canyon*, [3]*Texas AgriLife Research*, *Amarillo, TX*.

The high concentrations of some nutrients in distiller's grains (DG) make formulation of diets difficult and can lead to environmental concerns. These concerns will differ with feedlot location, feedlot size, diet formulation, and grain processing method used. Feeding DG in dry-rolled corn-based diets (DRC) does not apparently affect DM digestion or total DM excretion; whereas, with steam-flaked corn-based diets (SFC) the feeding of DG decreases DM digestibility. With SFC-based diets the quantity of pen manure collected increased about 10% for each 10% increase in dietary DG concentration (DM basis); whereas it increased 0 to 7% with DRC-based diets. With SFC-based diets, the N and P concentrations of collected manure were not affected by feeding of DG. Phosphorus excretion (and acres of cropland required for manure removal) increases approximately 10 to 25% for each 10% increase in dietary DG concentration. The effects of feeding DG on subsequent ammonia emissions may vary with season and dietary N concentrations. In our studies, N volatilization as a percentage of N intake, decreased about 20% when DG was fed (15 or 20% of DM); however, because of greater N intake, total N volatilization losses (kg/steer) were not affected. During production and storage, DG emit volatile organic compounds (VOC) that could potentially contribute to odors or ozone formation. High sulfur concentrations in DG could affect animal health as well as emissions of hydrogen sulfide and other odorants. British and Nebraska studies suggest that feeding of DG can decrease enteric methane production in high-roughage diets; however, the effects in high-concentrate diets are not known. To our knowledge, the effects of feeding DG on excretion of physiologically active compounds (antibiotics, hormones, etc.) have not been studied. In conclusion, it appears that the feeding of DG may have environmental effects that need to be considered when determining ingredient value and optimal diet formulations.

Key Words: Distiller's Grains, Beef Cattle, Environment

149 Precursors to enhance marbling. S. B. Smith*, J. E. Sawyer, R. D. Rhoades, and M. A. Brooks, *Texas A&M University*, *College Station*.

The overall process of lipid synthesis in marbling (intramuscular; i.m.) and s.c. adipose tissues is similar in that both incorporate the same long-chain fatty acids into neutral lipids, and both adipose tissues synthesize fatty acids *de novo* from acetate and glucose. However, the relative rates of incorporation of specific fatty acids, acetate, and glucose differ markedly between adipose tissue depots. Oleic acid (18:1n-9) and linoleic acid (18:2n-6) are incorporated into lipids in s.c. adipose tissue at nearly twice the rate observed in i.m. adipose tissue. Thus, any dietary treatment that increases absorption oleic or linoleic acid may promote adiposity of s.c. adipose tissue disproportionately. The rate of synthesis of lipids from acetate *in vitro* is as much as 10-fold greater in s.c. than in i.m. adipose tissue. However, the overall metabolism of glucose (to CO_2, lactate, and fatty acids) typically is greater in i.m. than in s.c. adipose tissue and, in i.m. adipose tissue, glucose can be the predominant *de novo* precursor

of fatty acids *in vitro*. Recent investigations have demonstrated that, as adipose tissue depots mature, response to insulin *in vitro* is reduced. In 24-mo-old, corn-fed steers, insulin had no effect on the incorporation of glucose into lipids in s.c. adipose tissue, but stimulated lipid synthesis from glucose in the less mature i.m. adipose tissue. In adipose tissues of hay-fed steers fed to the same BW as corn-fed steers, insulin was completely without effect on the conversion of glucose to lipid. The same pattern was confirmed in 16-mo-old, corn-fed steers, in that insulin nearly doubled the rate of glucose incorporation into lipids in i.m. adipose tissue, but had no effect in s.c. adipose tissue. Feedlot steers fed dry-rolled corn (DRC) plus 30% wet distillers grains (WDG) had nearly three times as much fecal starch as steers fed steam-flaked corn (SFC) plus 30% WDG. Marbling scores were greater in carcasses of steers fed DRC (540) than in steers fed SFC (496). These data indicate that greater passage of starch into the small intestine may increase free glucose absorption which in turn may stimulate insulin secretion; this would promote i.m. adipose tissue development.

Key Words: Beef Cattle, Marbling, Precursors

150 Post-harvest strategies to enhance beef quality. J. O. Reagan*, *NCBA*, *Centennial, CO*.

Producing a consistent, high quality beef product has been identified in beef quality audits as a primary key to increasing customer satisfaction and consumer demand. Improving beef quality traits, such as tenderness, flavor and juiciness, is complex as these traits are influenced by genetic and environmental factors (nutrition, health, management) at the production level, harvest and post-harvest management strategies and cooking methodology. While efforts are being made to improve beef quality through genetic evaluation and marker assisted selection, the primary pre-harvest strategy to enhance beef quality has been to utilize extended feeding periods on highly concentrated grain diets. Increased grain prices, driven partially by increased demand for grains from the biofuels industry, bring doubt to whether this feeding strategy will be economically viable in the future. Numerous post-harvest technologies have been utilized over the years with the primary target being the improvement of tenderness. Early technologies included post-mortem aging to increase protein degradation through enhanced enzyme activity, altering the rate of carcass chilling to prevent cold-shortening of muscle fibers, and mechanical tenderization to physically cut myofibrils via processes such as grinding and blade tenderization. High- and low-voltage electrical stimulation have been used to increase pH decline, to enhance the aging process and to create physical tearing of muscle fibers. Cutting and muscle stretching strategies have also been employed to increase sarcomere length through pre-rigor stretching. More recently, injection or marination of beef with enzymes, calcium, phosphates, salts, and anti-oxidants have been used to chemically tenderize beef by enhancing degradation of connective tissues or by increasing pH and water holding capacity. Continued high feed prices will potentially reduce beef quality due to reduced energy levels in diets and shorter feeding periods making post-harvest beef quality enhancement processes even more critical to maintaining consistent supplies of high quality beef.

Key Words: Beef, Quality, Post-Harvest

151 ASAS Centennial Presentation: Using grain and biomass for feed versus fuel. J. Lawrence*, *Iowa State University*, *Ames*.

Agriculture is amidst one of the largest changes since the move from horses to tractors. Ironically, as Ray points out, when we adopted petroleum we took land that was used to produce fuel for work animals or woodlots to heat our homes and moved it to food production. Currently, the US and the rest of the world are emphasizing renewable energy. This policy shift, reflected in the 2007 Energy Bill, grew out of a perfect storm of higher oil prices, national security interests since September 11, 2001 and lobbying efforts from agriculture and environmentalists. The mandated targets in the Energy Bill of 36 billion gallons a year of renewable fuels with 15 billion gallons coming from conventional (grain) sources by the year 2022 is an aggressive goal, but there is construction, earth moved and announcements made to reach these goals a decade ahead of schedule if economics cooperate. The demand for biofuel feedstock that was formerly feedstuffs is driving up prices for grains, forages and the land to produce them. Yet, in spite of near record high corn prices in early 2008, red meat and poultry production is forecast to be at record high levels. The impacts for animal agriculture will vary from producers to consumers. While feed cost is often 50-70% of animal production cost, it is typically less than 20% of the retail meat price and meat is a fraction of the consumer's food bill. Economics will serve as governor on the pace of ethanol expansion and will dictate the size of the livestock and poultry production sector in the future. The economic interactions are complex and given time and technology will find a new equilibrium where we produce both food and fuel, but in perhaps a different ratio than we have in the recent past. Economic modeling to date shows a rather modest change in long-run livestock and poultry production. This paper will discuss the winners and losers, and potential unintended consequences?

Key Words: Ethanol, Biofuels, Food