For decades, the “efficient cow” has been the holy grail of the beef cattle seedstock industry. Increases in beef production often have been possible due to enhancements in reproduction, nutrition, genetics, and management, or their combination. Nonetheless, beef production still is perceived as a relatively inefficient process from the standpoint of energy utilization. Modeling is a tool that allows us to combine scientific knowledge of biology into a mathematical form. These models can be used to identify optimal solutions for diverse production scenarios. So far, our modeling efforts have utilized equations developed from data generated by individuals that were sampled from the population (macro level). The figure below illustrates the histogram of energy efficiency index (EEI) computed with our current model. In this figure, cows with less than 36.8 Mcal of energy requirement per kg of calf weaning weight would be extremely efficient, and they represent 5% of the population. The distribution of EEI is skewed to the right; that is where less efficient cows reside. With recent advances in genomics, the identification of intrinsic genetic factors that determine the phenotype of an individual can be used in building models that are designed to more closely mimic requirements and performance of a particular individual, thus increasing the accuracy and precision of the model prediction.

Which type of cows is more productive and profitable under specific conditions? What is the best supplementation under these conditions? When should the sire specifications be changed to improve EEI? To which side will the EEI distribution likely shift if a given sire is used? Strategic and tactical recommendations can provide ranchers, industry, and state/federal policy makers critical information about the impacts on cattle production. Texas AgriLife Research scientists have developed a cow/calf efficiency model that can be used to assist in the identification of efficient cows and to simulate different scenarios of production to identify optimum management systems. This model is at the macro level; research is under way to gather information to build an individual-based model.

Objectives

- Develop and evaluate the individual-based model for production efficiency of beef cows using genomic and biomarker information.
- Unveil the distribution of the production efficiency of different cattle herds across Texas.
- Determine seasonal and long-term changes in production efficiency of different simulated scenarios of each ranch.
- Validate the accuracy of the individual-based model to identify efficient grazing cows.

Outcomes

- The individual-based model will assist ranchers in the decision-making process to identify efficient cows and strategize on supplemental feeding to maximize profitability.
- Stochastic modeling will allow industry leaders in selecting the desired sire characteristics for the herd in order to maximize production efficiency under specific ranch conditions.
- Third-party companies that process genetic markers will be able to provide customers with specific panels of genetic markers that would instruct individual-based models to perform additional calculations, based on their unique information. These additional calculations are proprietary of the third-party companies and will be available only for their customers.