National Program for the Genetic Improvement of Feed Efficiency in Beef Cattle
The Participants

University of Missouri

Iowa State University
Dr. Dorian Garrick
Dr. Stephanie Hansen
Dr. Dan Loy
Dr. J.R. Tait

Texas A&M University
Dr. Chris Seabury

University of Illinois
Dr. Jon Beever
Dr. Dan Faulkner
Dr. Dan Shike

University of Minnesota
Dr. Scott Fahrenkrug

University of Missouri
Dr. Jerry Taylor, Project Director
Dr. Monty Kerley
Dr. Robert Schnabel

Kansas State University
Dr. Robert Weaber

University of Nebraska
Dr. Matt Spangler

GeneSeek, A Neogen Company
Dr. Daniel Pomp

USDA-BELTSVILLE
Dr. Tad Sonstegard

USDA-MARC
Dr. Harvey Freety
Dr. John Pollak

Washington State University
Dr. Kris Johnson
Dr. Holly Nelbergs

United States Department of Agriculture
National Institute of Food and Agriculture

20 investigators 10 institutions
Overview

- Feed Efficiency as a trait of economic importance
- Trends in feed efficiency
- Overview—National program for the genetic improvement in feed efficiency
  - Genetic research
  - Nutrition and G X N research
  - Demonstration/field project
  - Extension and outreach effort
Feed costs and profitability

- Feed costs have historically been 50–70% of the cost of production in beef enterprises.
- As corn prices approach and exceed $7 per bushel, feed costs are nearly 80% of the cost in many feedlot operations.
- A feed efficiency improvement of approximately 10% (2 pound reduced RFI) across the entire feedlot sector would reduce feed costs $1.2 Billion in 2011 (Weaber, 2011).
- Fewer resources used = improved global food security.
Understanding the components of feed efficiency

- More efficient cattle may have improved digestion or absorption of nutrients, or

- More efficient cattle may utilize absorbed nutrients more efficiently
Understanding the components of efficiency

📍 Maintenance
  ◦ Genetic and environmental component
  ◦ Impacted by metabolic rate, cellular efficiency

📍 Production
  ◦ Growth—impacted by body composition, nutrient partitioning
  ◦ Fetal growth, milk production, body condition change

📍 Cow efficiency—reproductive, production

📍 This study is focused on efficiency of feed utilization
Fifteen years of Iowa Feedlot Enterprise Records (Feed Conversion Ratio, 1978–1992)

Rate of Change-- .047 lb./year

1 pound improvement in FE/20 years

Loy (1993)
Fifteen years of Midwestern Feedlot Closeouts (Feed Conversion Ratio, 600–800 lb. steers, 1988–2002)

Rate of Change—.033 lb./year

Loy (2004)  1 pound improvement in FE/30 years
Midwestern Closeout Summaries (Feed Conversion Ratio, 700–800 lb. steers, last 10 years)

Rate of Change—none

Land O’ Lakes/Purina Feeds, yearly closeout summaries
http://www.beeflinks.com/articles.htm
Kansas Feedlot Performance
and
Feed Cost Summary

Feed Efficiency

(Reinhardt, Waggoner, KSU)
Conclusion—Feedlot Closeout data

- The rate of improvement has slowed

- The genetics of feed efficiency is a largely untapped source of improvement
# Measuring Feed Efficiency

## Comparison of Feed Efficiency Terms

<table>
<thead>
<tr>
<th>Method</th>
<th>More Desirable</th>
<th>Less Desirable</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw F:G – Raw Feed Conversion:</td>
<td>Lower values</td>
<td>Higher values</td>
<td>Example: 3.0 lbs of feed</td>
</tr>
<tr>
<td>usually on dry matter basis (lbs feed/lb of</td>
<td>Example: 4.5 lbs</td>
<td>Example: 7.5 lbs</td>
<td></td>
</tr>
<tr>
<td>gain)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. F:G – Adjusted Feed Conversion:</td>
<td>Lower values</td>
<td>Higher values</td>
<td>Example: 2 lbs of dry matter</td>
</tr>
<tr>
<td>usually on dry matter basis (lbs feed/lb of</td>
<td>Example: 4.5 lbs</td>
<td>Example: 6.5 lbs</td>
<td></td>
</tr>
<tr>
<td>gain)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFI – Residual Feed Intake:</td>
<td>Negative values</td>
<td>Positive values</td>
<td>Example: 3.2 lbs of feed</td>
</tr>
<tr>
<td>usually on dry matter basis</td>
<td>Example: -1.7</td>
<td>Example: +1.5</td>
<td></td>
</tr>
<tr>
<td>R-ADG – Residual Average Daily Gain:</td>
<td>Positive values</td>
<td>Negative values</td>
<td>Example: 1.49 lbs of average daily gain</td>
</tr>
<tr>
<td>usually on lbs gained per day</td>
<td>Example: +0.86</td>
<td>Example: -- .63</td>
<td></td>
</tr>
<tr>
<td>Adj. DMI – Adjusted Dry Matter Intake:</td>
<td>Negative values</td>
<td>Positive values</td>
<td>Example: 1.7 lbs of feed</td>
</tr>
<tr>
<td>should be on dry matter basis</td>
<td>Example: -0.9</td>
<td>Example: +0.8</td>
<td></td>
</tr>
</tbody>
</table>

Dahlke et al (www.iowabeefcenter.org/Docs_cows/IBC41.pdf)
The Project

- Up to 5 Year/$5M USDA NIFA funded project
  - April 1, 2011 to March 31, 2016
  - 2/3 fundamental and applied research
  - 1/3 extension and outreach
  - Demonstration project involves 24 collaborating producers and a commercial feedlot
Research Objectives

- Assemble DNA samples, individual FI, growth and carcass composition data for 8,000 animals representing 8 major beef breeds

<table>
<thead>
<tr>
<th>Breed</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angus</td>
<td>698 (MU)</td>
<td>600 (UI)</td>
<td>200 (MU)</td>
<td>300 (MU)</td>
<td></td>
<td>1798</td>
</tr>
<tr>
<td>Red Angus</td>
<td>300 (UI)</td>
<td>300 (UI)</td>
<td></td>
<td></td>
<td></td>
<td>600</td>
</tr>
<tr>
<td>Simmental</td>
<td>1139 (UI)</td>
<td></td>
<td>300 (MU)</td>
<td></td>
<td></td>
<td>1439</td>
</tr>
<tr>
<td>Gelbvieh</td>
<td>300 (MU)</td>
<td>100 (MU)</td>
<td>60 (WSU)</td>
<td>60 (WSU)</td>
<td>50 (USMARC)</td>
<td>50 (USMARC)</td>
</tr>
<tr>
<td>Charolais</td>
<td>60 (WSU)</td>
<td>450 (UI)</td>
<td>450 (UI)</td>
<td></td>
<td></td>
<td>1300</td>
</tr>
<tr>
<td>Hereford</td>
<td>300 (AHA)</td>
<td>300 (AHA)</td>
<td>300 (AHA)</td>
<td>50 (USMARC)</td>
<td>50 (USMARC)</td>
<td>1600</td>
</tr>
<tr>
<td>WagyU</td>
<td>70 (WSU)</td>
<td>70 (WSU)</td>
<td>70 (WSU)</td>
<td>70 (WSU)</td>
<td>70 (WSU)</td>
<td>350</td>
</tr>
<tr>
<td>Limousin</td>
<td>42 (ISU)</td>
<td>42 (ISU)</td>
<td>42 (ISU)</td>
<td>42 (ISU)</td>
<td>50 (USMARC)</td>
<td>50 (USMARC)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3509</td>
<td>1522</td>
<td>1222</td>
<td>972</td>
<td>672</td>
<td>7897</td>
</tr>
</tbody>
</table>
The Project

- Research objectives to improve beef cattle feed efficiency:
  - Genotyping will include high density (700 K) SNP or imputed from 50K
  - Develop national across-breed genomic selection program
  - Identify nutritionally driven (forage-concentrate) interactions
The Project

- Research objectives to improve beef cattle feed efficiency:
  - Evaluate the genetics of microbial population establishment and the effects on efficiency
  - Identify genes controlling metabolism
  - Efficiency differences associated with mitochondrial and nuclear genomes
  - Detailed evaluation of high and low RFI cattle, including a repository of tissues for future analysis
Extension Program Goals

- Highly integrated with research component
  - Technology transfer
- Involves stakeholders early in the process
- Engages all segments of the industry
- Demonstrates progress in efficiency change by stakeholders by project conclusion
- Industry education component (tied to research results)
Field demonstration project will demonstrate utility of molecular EBVs for FE and component traits and “test drive” the technology in seedstock herds:

- 50K MEBVs for WW in Y1
- MEBVs for feed intake/efficiency in Y3
AI Sires

2009 Born Females Heifer stayability

AI & Herd Bulls sire 2010 calf crop in collaborator herds

AI 900 cows

Crossbred Steers
  Rex Ranch (2011) & USMARC (2011 and 2012)

FE (2012)
FE (2012 & 2013)

Feedlot (2013)
  Marker Assisted Management

BEEF EFFICIENCY
  RESEARCH, EDUCATION, EXTENSION
Marker assisted management

- Identify nutrition or management by genetic interactions
- Determine practical sources of information
  - Reduced panel tests
  - Genetic information
- Management based on genetic knowledge
  - Nutrition and management
  - Sorting into outcome or management groups
Industry Feedback

- Advisory board that includes demonstration project participants, plus representatives of feedlot sector.
- Will meet annually to give feedback.
Overview/Introduction

The sustainability of the beef industry continues to be a real issue in agriculture today. Will the industry be able to survive high feed and land prices? A $5 million USDA-NIFA Agriculture and Food Research Initiative grant has been awarded to a multi-disciplinary group of researchers from eight institutions to develop DNA-based technology to predict genetic merit for feed efficiency.

"Currently, we have no highly effective tools to improve feed efficiency, which can lead to an increase in greenhouse gas emissions and demand for additional land to produce feed," said Jerry Taylor, Wurzack Chair in Animal Genomics in the University of Missouri College of Agriculture, Food and Natural Resources, and project director. "Historically, the only way we have improved the efficiency of cattle growth was by selectively breeding cattle that grew fast. While this reduced the time it took to bring an animal to market, it did not tackle the fundamental issue of improving the efficiency of converting nutrients from feed into beef."

In this study, phenotypic data will be collected on 3,000 cattle representing eight breeds, including Angus, Red Angus, Simmental, Gelbvieh, Charolais, Hereford, Limousin and Wagyu. Researchers will evaluate intake, performance and carcass traits. In addition, they will collect DNA samples for gene mapping. After the data are compiled, the team's goal is to deliver tools and knowledge which enable genetic selection for feed efficiency.

http://www.beefefficiency.org/homepage.html
Resources Today

- [www.beefefficiency.org](http://www.beefefficiency.org)
- Conference presentations
- Updates on NCBA’s Cattlemen–to–Cattlemen (first segment November 8, 2011)
- NCBA Cattlemen’s College (February 1, 2012)
Coming Soon

- Factsheets and presentation materials to support local programming
- Decision aides for management support
- Annual conferences
- Producer survey to establish baseline knowledge and technology use.
To stay informed

Contact one of the team members, or

Click the “Contact Us” button on the website

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