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

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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
- Why is a feedlot nutritionist interested in the genetics of feed efficiency?

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

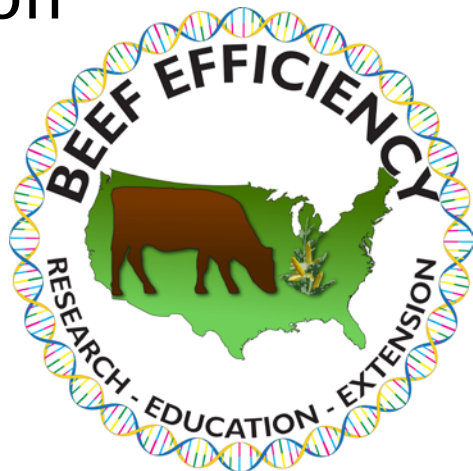
Understanding the components of feed efficiency

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

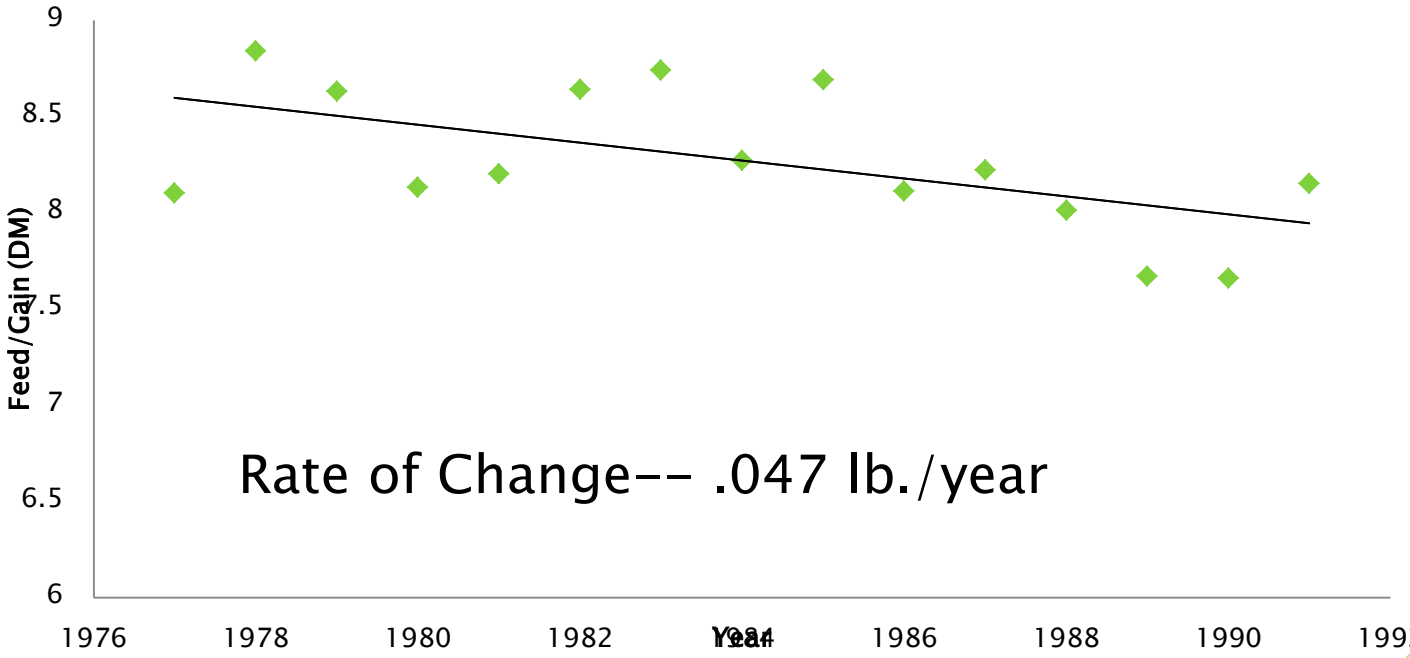
- More efficient cattle may utilize absorbed nutrients more efficiently

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



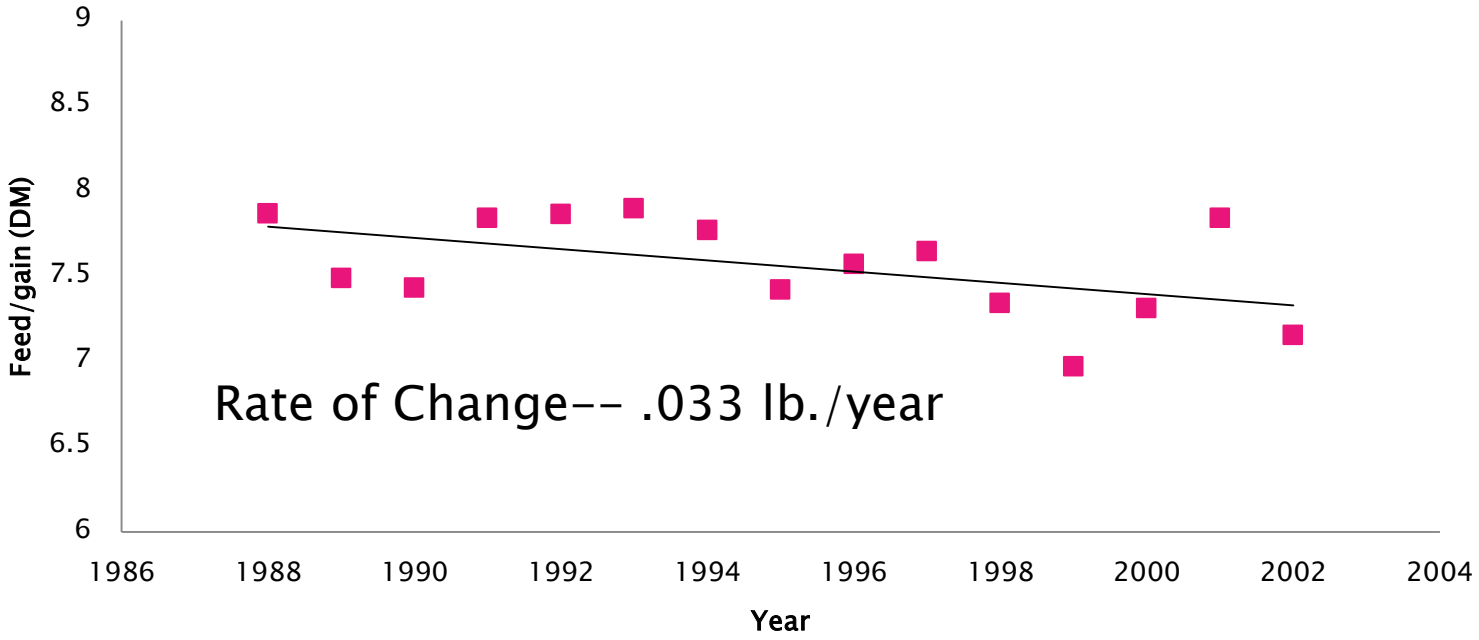
Fifteen years of Iowa Feedlot Enterprise Records (Feed Efficiency, 1978-1992)



1 pound improvement in FE/20 years

Loy (1993)

Fifteen years of Midwestern Feedlot Closeouts (Feed Efficiency, 600-800 lb. steers, 1988-2002)



Loy (2004)

1 pound improvement in FE/30 years

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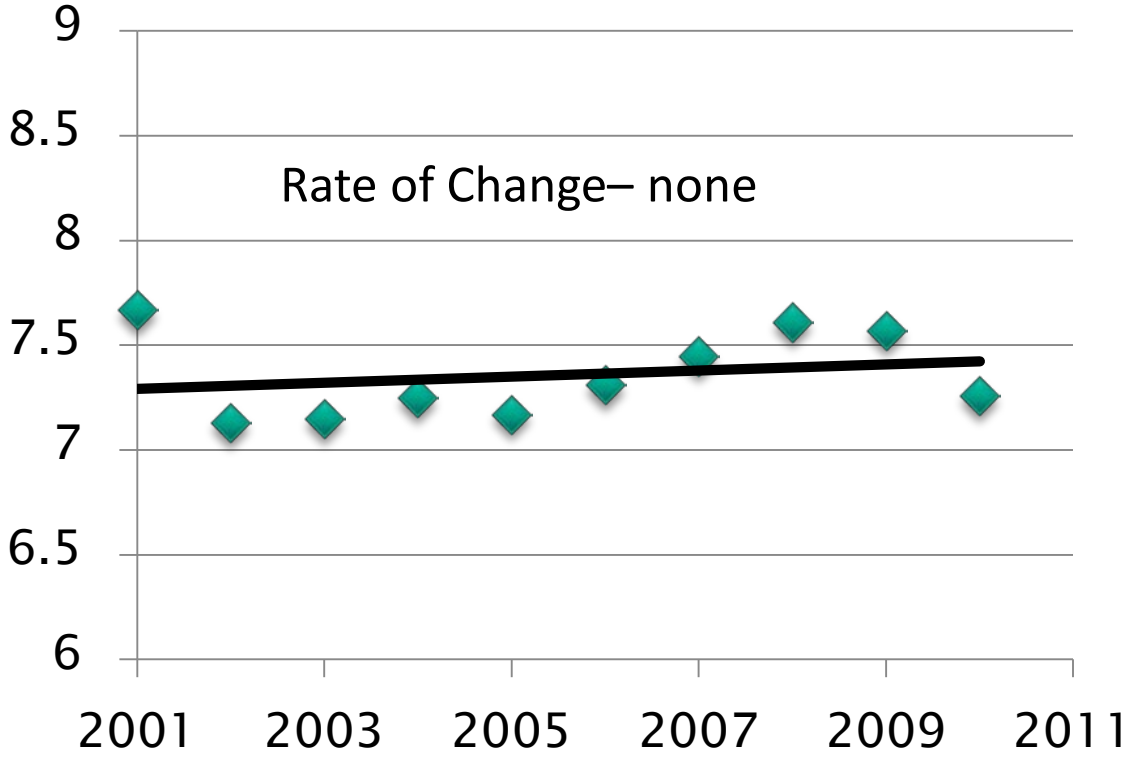
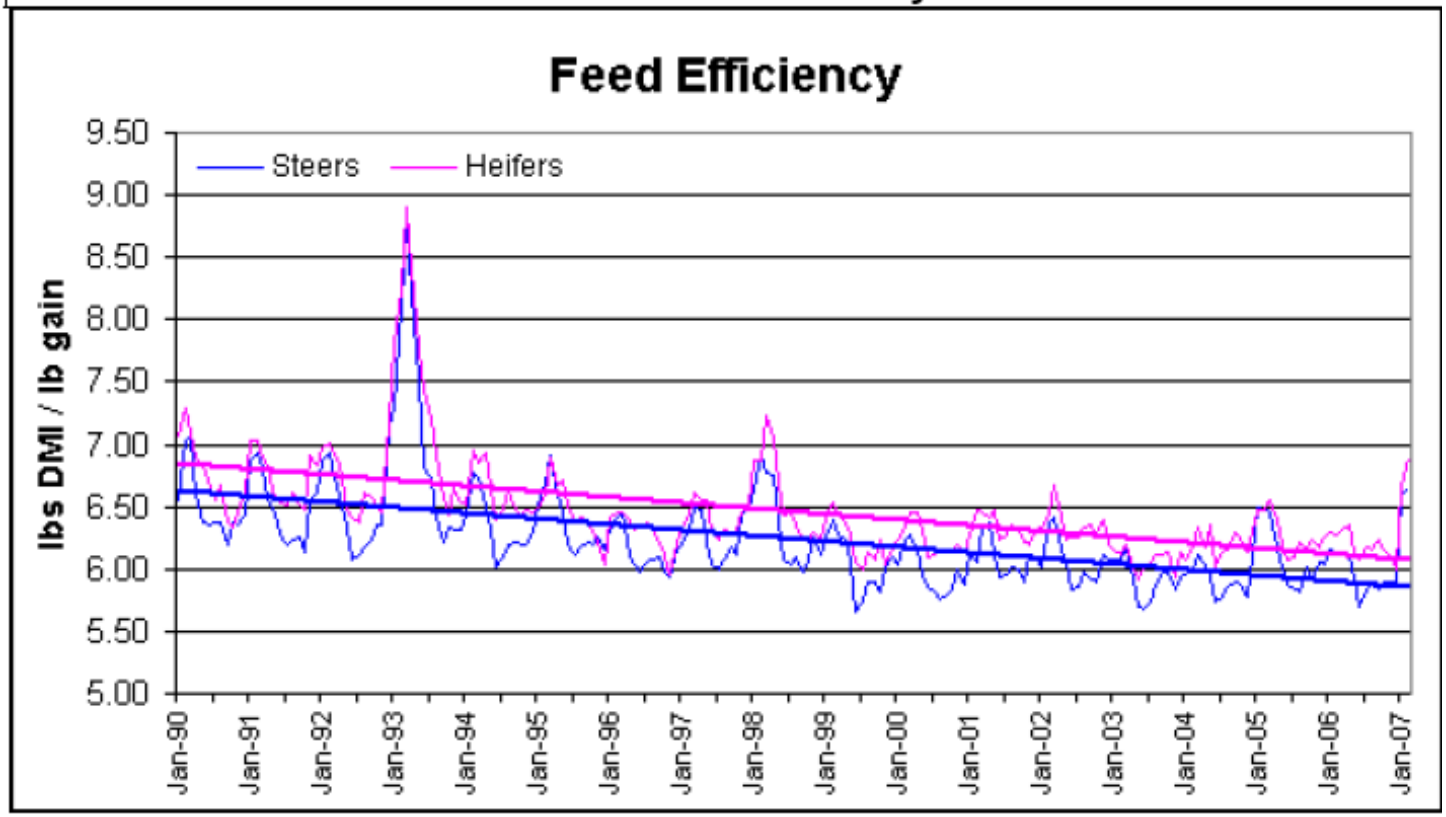
Midwestern Closeout Summaries (Feed Efficiency, 700-800 lb. steers, last 10 years)



Land O' Lakes/Purina Feeds, yearly closeout summaries
http://www.beeflinks.com/articles.htm

Focus on Feedlots

Kansas Feedlot Performance
and
Feed Cost Summary



(Reinhardt, Waggoner, KSU)

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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

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

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

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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

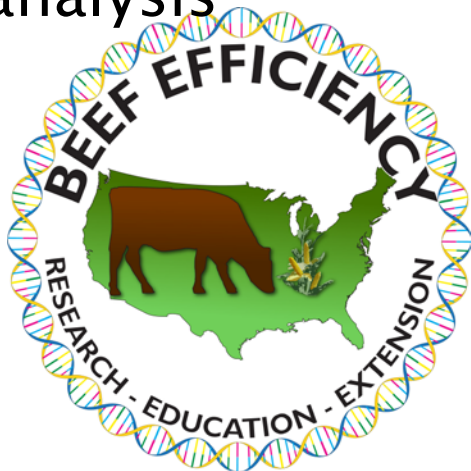
	Year[a]					
Breed	**1**	**2**	**3**	**4**	**5**	**Total**
Angus	698 (MU) 600 (UI)	200 (MU)		300 (MU)		1798
Red Angus	300 (UI)	300 (UI)				600
Simmental	1139 (UI)		300 (MU)			1439
Gelbvieh	300 (MU)	100 (MU)		50 (USMARC)	50 (USMARC)	500
Charolais	60 (WSU)	60 (WSU) 450 (UI)	60 (WSU) 450 (UI)	60 (WSU) 50 (USMARC)	60 (WSU) 50 (USMARC)	1300
Hereford	300 (AHA)	300 (AHA)	300 (AHA)	300 (AHA) 50 (USMARC)	300 (AHA) 50 (USMARC)	1600
Wagyu	70 (WSU)	70 (WSU)	70 (WSU)	70 (WSU)	70 (WSU)	350
Limousin	42 (ISU)	42 (ISU)	42 (ISU)	42 (ISU) 50 (USMARC)	42 (ISU) 50 (USMARC)	310
Total	3509	1522	1222	972	672	7897

The Project

- **Research objectives to improve beef cattle feed efficiency**:
  - Genotyping will included 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)

Extension Field Project

- 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

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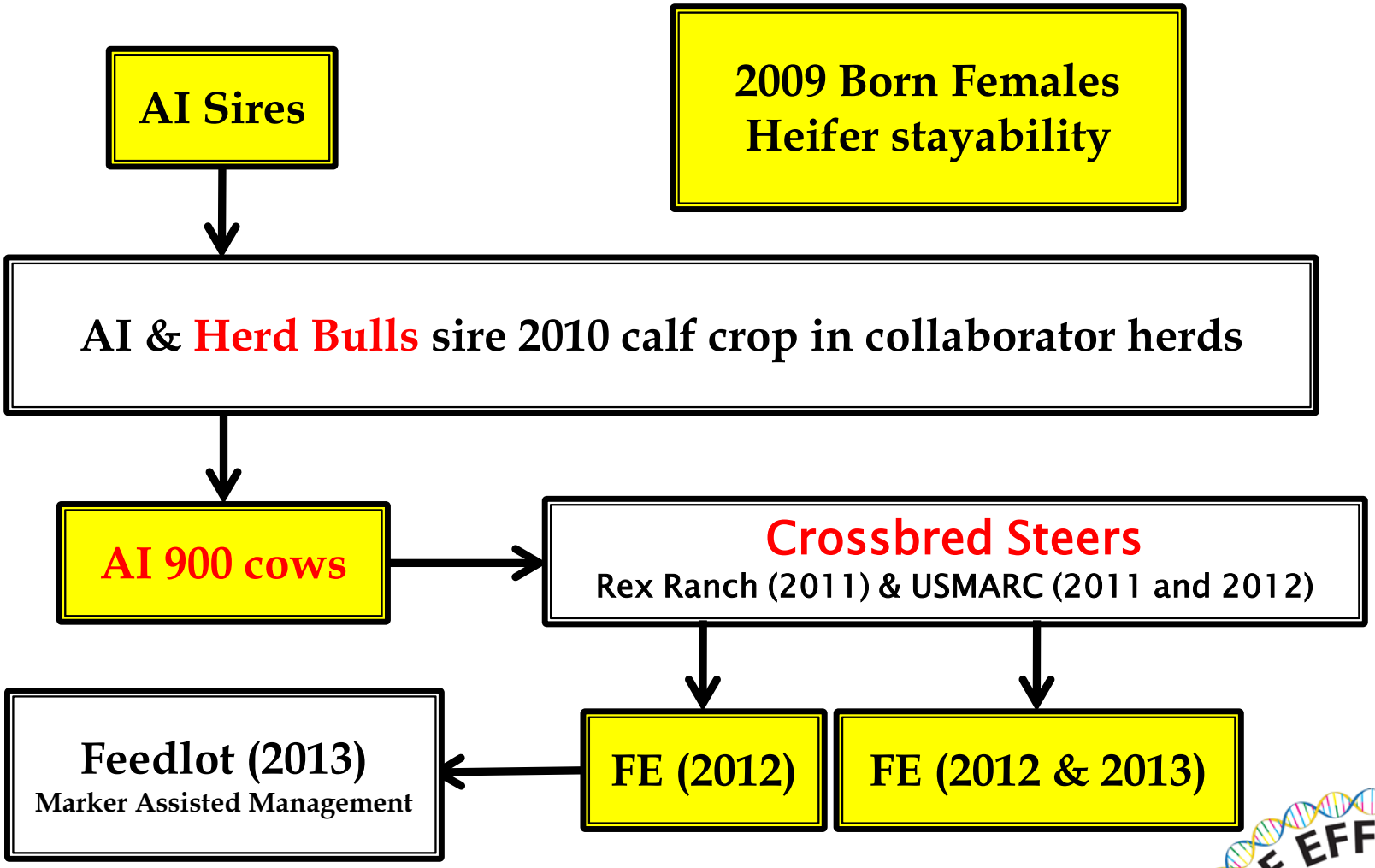
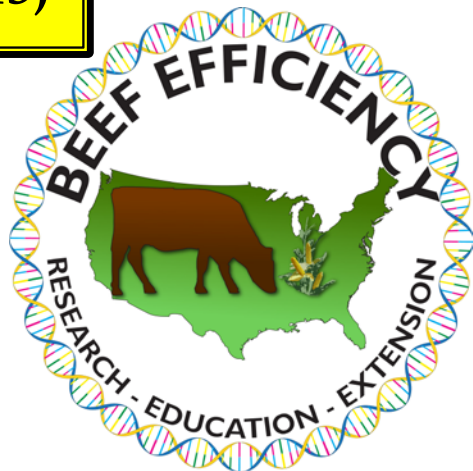

AI Sires
2009 Born Females
Heifer stayability
AI & Herd Bulls sire 2010 calf crop in collaborator herds
AI 900 cows
Crossbred Steers
Rex Ranch (2011) & USMARC (2011 and 2012)
Feedlot (2013)
Marker Assisted Management
FE (2012)
FE (2012 & 2013)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Marker 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.

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http://www.beefefficiency.org/

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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, Wurdack 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 8,000 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.

News Articles.

BIF: Five Year National Feed Efficiency Study

Healthier and More Efficient Cows

UNL, Other Universities Get Cattle Feed Efficiency Research Grant

$5 million USDA grant targets feed efficiency in beef cattle

Iowa State Faculty Part of Feed Efficiency Study of Beef Cattle

Watch for more information avail from

Iowa State University Beef Center

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

Resources Today

- 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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