Beef Cattle Feed Efficiency

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Outline

- Introduction
- Definitions of feed efficiency
- Feedlot closeout data
- Challenges we face
- New technology
- Cow efficiency
- Summary

Why all the buzz about efficiency?

- Decreasing acres for crop production
- Increasing world population
- Increased utilization of food for fuel
- Increasing feed cost (including forages)
- Other inputs increasing in cost (fuel, transportation, fertilizer)

Feed costs and profitability

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

A 1% improvement in feed efficiency has the same economic impact as a 3% improvement in rate of gain

Measures of feed efficiency

- Gross feed efficiency: ratio of live-weight gain to dry matter intake (DMI)
  - 0.12 – 0.22 (higher number better)
- Feed conversion ratio (FCR): DMI to gain ratio
  - 4.5 – 7.5 (lower number better)
- FCR is a gross efficiency measurement – DOES NOT attempt to partition feed inputs into portions needed to support maintenance and growth requirements

Measures of feed efficiency

- Why not just select for FCR?
- FCR is negatively correlated with:
  - Postweaning ADG
  - Yearling BW
  - Cow mature size

Risks of selecting for FCR

- Selecting for improved FCR will indirectly:
  - Increase genetic merit for growth
  - Increase cow mature size
  - Increase feed costs for the cow herd

Measures of efficiency

- Residual Feed Intake (RFI)
  - The difference between actual intake and predicted intake based on animal's gain, maintenance requirements for its body weight, and composition
  - NEGATIVE RFI IS GOOD!
    - Required less feed then predicted
  - Independent of growth and mature size
  - Linked to biologically relevant traits associated with feed efficiency
    - Digestibility, heat production, protein turnover

Measures of efficiency

- Residual Average Daily Gain (RADG)
  - The difference between actual gain and predicted gain based on animals intake, maintenance requirements for its body weight, and composition
  - POSITIVE RADG IS GOOD!
    - Gained more weight than predicted
  - Correlated to growth

On a feed:gain basis, beef cattle are least efficient compared to other livestock

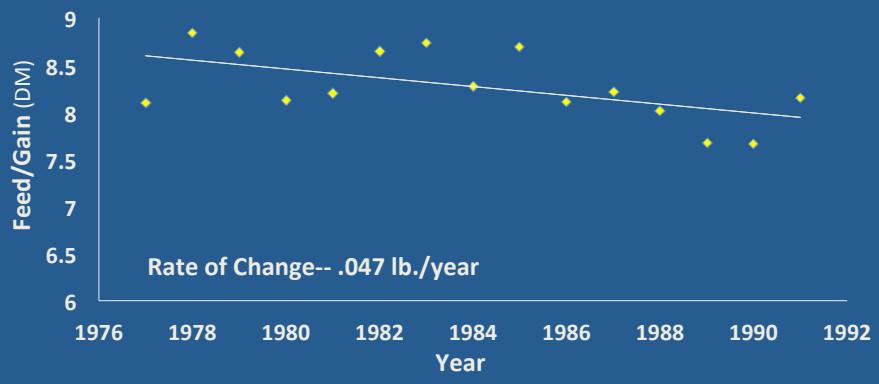


< 2:1 < 3.5:1 > 6:1

Poultry Improvement

- **250%** improvement in efficiency since 1957

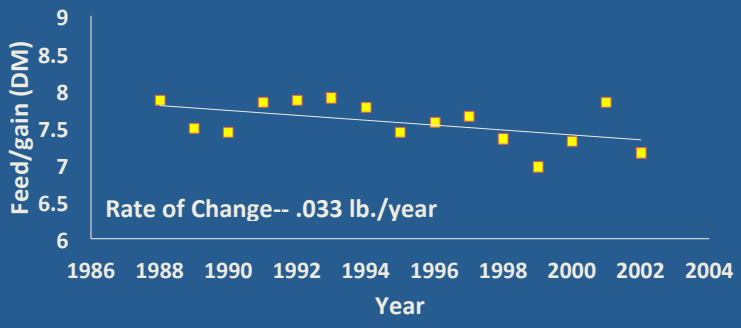
Fifteen years of Iowa Feedlot Enterprise Records (Feed Efficiency, 1978-1992)



1 pound improvement in FE/20 years

Loy, 1993

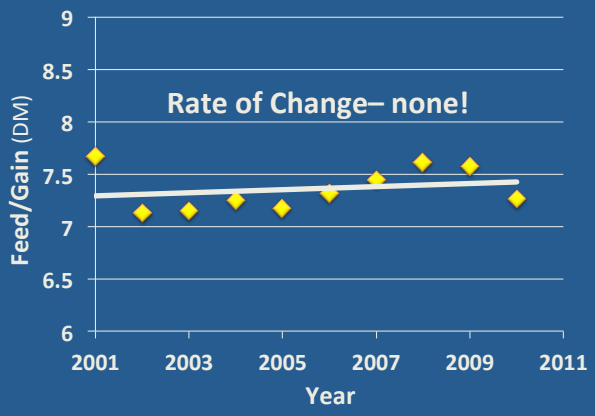
Fifteen years of Midwestern Feedlot Closeouts (Feed Efficiency, 600-800 lb. steers, 1988-2002)



1 pound improvement in FE/30 years

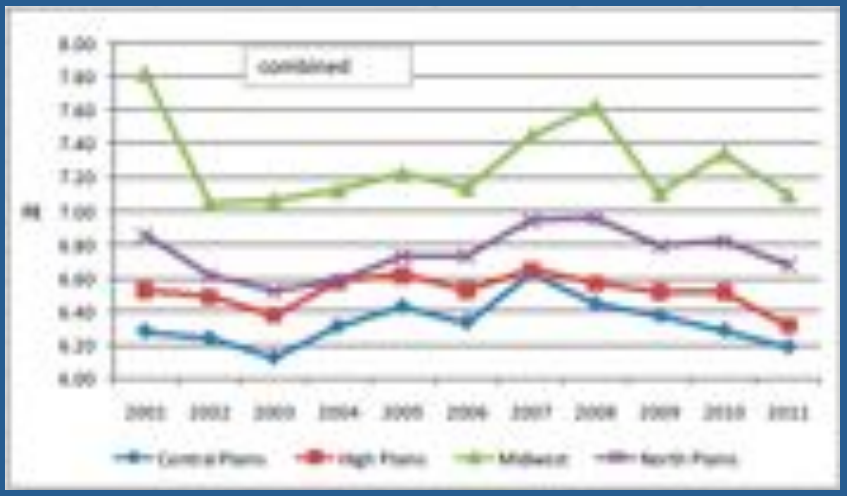
Loy, 2004

Midwestern Closeout Summaries (Feed Efficiency, 7-800 lb. steers, last 10 years)



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

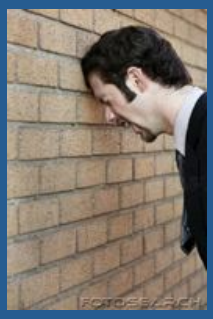
Past 10 Years of Feedlot Closeouts



Robert Botts, Elanco Beef

Conclusion—feedlot closeout data

- Little to no improvement in feed efficiency
- Improvement has slowed in past decade



Why are beef cattle less efficient?

- Feed higher fiber diets

Why are beef cattle less efficient?

- Rumen Fermentation
- Bacteria produce VFA's
- Bacteria produce methane

Why are beef cattle less efficient?

- High maintenance requirement
- > 50% of feed intake used for maintenance

Why haven't we improved efficiency?

- No selection for feed efficiency
- Why?
  - Individual feeding
  - Expensive facilities
  - High labor requirement
  - Lack of social interaction
  - Difficult to compare at varying body compositions

Calan gates used for individual feed consumption research.

Advances in technology allowing improved feed efficiency measurement

- GrowSafe Units
  - Radio frequency ID
  - Wireless communication
  - Custom software giving < 2% error in feed intake

Advances in technology allowing improved feed efficiency measurement

- Ultrasound technology
- Repeated measurements:
  - 12 th rib backfat
  - Rump fat
  - Marbling
  - Ribeye area

How does feedlot efficiency relate to cow efficiency?

- Most research is currently focused on feedlot
  - Logical place to start
  - Feedlots know how much feed they buy
  - Improvements will be easy to document

Beef cow efficiency

- What about cow efficiency?
  - ~70% of feed resources for cowherd
  - ~70% of feed for maintenance
  - 50% OF ALL FEED TO MAINTAIN COWHERD
- How do we define cow efficiency?
  - Pounds of calf weaned per unit of feed intake
  - What about reproduction
  - What about longevity

Maintenance energy

High Maintenance Cow

- High milk production
- High visceral organ weight
- High body lean mass
- Low body fat mass
- High output and high input

Low Maintenance Cow

- Low milk production
- Low visceral organ weight
- Low body lean mass
- High body fat mass
- Low output and low input

Environment

Restricted feed resources

- Favors more moderate size, moderate milk production
- "Low maintenance" breeds are most efficient
  - Angus, Red Poll
- High maintenance breeds are least efficient
  - Simmental, Charolais, Limousin, Gelbvieh

Abundant feed resources

- Favors larger, heavier milking biological types
- "High maintenance" breeds are most efficient
  - Simmental, Charolais, Limousin, Gelbvieh
- Low maintenance breeds are least efficient
  - Hereford, Red Poll, Angus**

Jenkins and Ferrell, 1994

Intake

- Why not just select for intake?
  - Who wants cows with extremely high intake?
  - Who wants cows with extremely low intake?
    - Does that mean we would have selected for cows with poor appetite or that don't want to actively forage?

Variation in cow efficiency

	Small Cow	Big Cow	Moderate Cow	Moderate Cow
BW, lbs	1186	1453	1306	1308
Milk Production, lbs	15.8	23.0	17.8	20.4
Hip Height, in.	52	53.0	53.0	53.5
BCS	5.5	6.0	6.0	5.5
DMI, lbs	56.6	45.4	54.4	35.8

Adcock et al., 2010

Beef cow efficiency

- Can we select for improved feed efficiency in the feedlot without having negative impacts on the cowherd?
- Or better yet is there a way to select for improved feed efficiency in feedlot that will improve cow efficiency?

Beef cow efficiency

- What about diet type?
  - Feedlot efficiency trials – high-energy, grain-based
  - Cowherd – moderate to low-energy, forage-based
- Why would they be the same?
  - Maintenance energy (heat production, protein turnover)
- Why might they be different?
  - Intake regulation
    - Grain – chemostatic
    - Forage – fill-regulated

Comparing RFI (forage vs. grain)

Comparing Grain and Forage RFI (steers on grain/heifers on forage)

Sire	Grain RFI	Forage RFI
A	-1.18	-.12
B	-0.98	-.33
C	-0.90	.88
D	-0.69	-.28
E	-0.55	-.35
F	-0.27	.78
G	-0.18	-.38
H	-0.16	-.52

Comparing Grain and Forage RFI (steers on grain/heifers on forage)

Sire	Grain RFI	Forage RFI
I	-0.10	.38
J	0.02	.93
K	0.13	-1.06
L	0.13	.18
M	0.38	.21
N	0.63	.03
O	0.74	-.47
P	0.85	.61

Forage vs. Grain

- Need to collect more data
  - Collecting forage and grain intake on 900 cattle over next 2 years
- Identify genetics that are superior for both
- Let the geneticists figure out how to select for it!!

Summary

- Changing dynamics put spotlight on efficiency
- Several definitions of feed efficiency
- Beef industry has made minimal progress
- New technology will facilitate progress
- Cow efficiency has unique challenges
- Still have much to learn!!