

Toward implementing prototype EPD for additional traits

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Feed Accounts for 65-70% of Production Costs

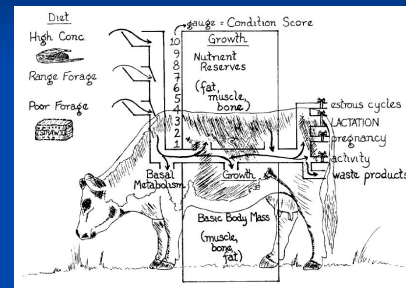


Beef cattle are less efficient than other protein food sources



Goal

- Develop EPD to reduce use of feed in production of beef



Short et al., 1990

Background

- Ratios are not satisfactory measures of efficiency (Tanner, 1949; Weil, 1962; Atchley et al., 1976).
- Koch et al. (1963) recommended use of gain adjusted for feed intake as the preferred measure of biological efficiency because it was considered the most accurate mathematical description of cause and effect.
- Combining feed intake and growth to calculate a single measure of feed efficiency does not add additional information to that which can be obtained directly from the component traits (Kennedy et al., 1993).
- Selection indexes require feed intake and growth (MacNeil et al., 1994; MacNeil and Herring, 2005).

Trait Definition

- Feed Intake**
 - Indicator traits
 - Use in Indexes
- It's a bit messy**
 - Different rations – with variable amounts of info
- Helpful circumstances**
 - Large number of animals in each contemporary group
 - Automated data collection with some quality control

Analysis Approach

- BIF approach for normally distributed traits
- Multiple trait models
 - Indicator traits increase accuracy and number of animals evaluated
 - Overcome selection bias
- Standardize intake data within contemporary groups
- Efficiency and index values, after primary trait analysis

ASA Data Description

- 825 Steers: Simmental, Angus, and Sim-Ang sires
- 2 years
- 3 Montana ranches
- 41 sires (progeny randomly assigned to diet.)
- Individually fed, University of Illinois



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AAA Data Description

	Records	Contemporary Groups
■ Feed Intake:	4,215	51
■ Weaning weight:	18,169	661
■ Post-weaning gain:	7,372	441
■ Ultrasound fat depth:	5,079	238

■ 2039 animals have a complete record



Data Analysis

- Pedigree 45,121 animals
- 4-trait animal model
 - Contemporary group /trait
 - Direct genetic effects
 - ASREML



Genetic Parameter Estimates

■ ADG	0.37±0.16	0.00±0.28	0.10±0.42	-0.74±0.32
■ Mid-Wt		0.73±0.20	0.55±0.33	-0.56±0.25
■ FI			0.13±0.11	0.21±0.52
■ RFI				0.25±0.14

- Large SE – need more data and larger contemporary groups.
- RFI may not be genetically independent of ADG or Mid-Wt.
- Genetic antagonism between growth and intake << than anticipated.
- Selection for FI > 3x as effective in reducing FI as selection for RFI.
- Selection for increased growth reduces RFI - selection for decreased RFI increases growth.

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Heritability Estimates

■ Weaning weight	0.41 ± 0.03
■ Post-weaning gain	0.31 ± 0.04
■ Ultrasound fat depth	0.39 ± 0.05
■ Feed Intake	0.31 ± 0.05

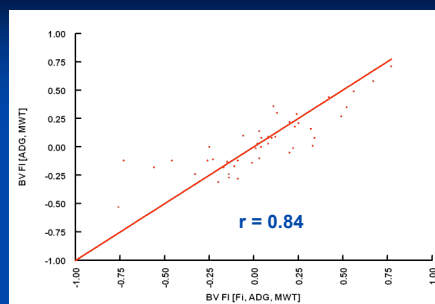


Genetic Correlations

■ WWT, GAIN	0.41 ± 0.03
■ WWT, FAT	0.09 ± 0.09
■ GAIN, FAT	0.17 ± 0.10
■ WWT, FI	0.50 ± 0.08
■ GAIN, FI	0.61 ± 0.10
■ FAT, FI	-0.12 ± 0.13



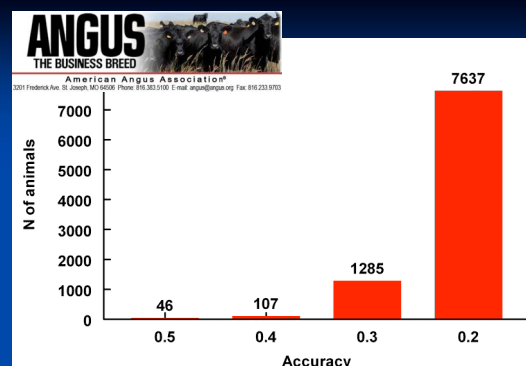
Prediction of BV for FI



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Genetic Evaluation

■ 45,121 EPD for feed intake		
	Accuracy	N
■ Pedigree estimate	0.08	
■ Weaning weight, only	0.13	9,874
■ 365-d weight, only	0.17	1,523
■ 365-d weight + scan	0.19	2,838
■ Complete record	0.29	2,039
■ Weaning weight + feed	0.24	1,089

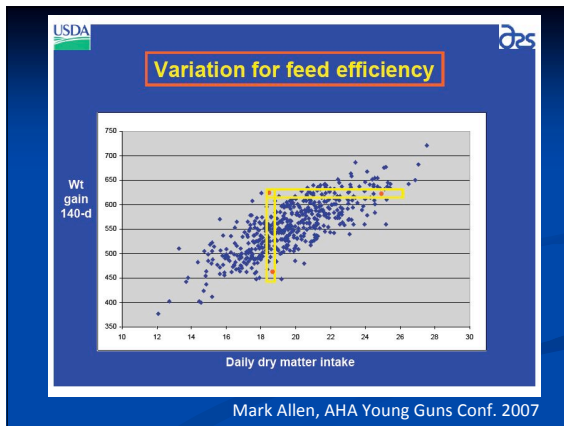


Indexes

- Indexes
 - Formulate "stereotypic" ration
 - "De-standardize" intake EPD consistent with ration
 - Cost (long-term average) ration
 - Incorporate into appropriate indexes
 - Assuming $I = \sum a_i \cdot EPD_i$

Efficiency

- Four options
 - Residual Feed Intake
 - Weaning weight, Gain
 - Weaning weight, Gain, Fat depth
 - Residual Gain
 - Feed Intake
 - Feed Intake, Fat depth



Efficiency – “Residual Gain”

$$\begin{bmatrix} \text{Var}(\text{FI}) & \text{Cov}(\text{FI}, \text{FAT}) \\ \text{Cov}(\text{FI}, \text{FAT}) & \text{Var}(\text{FAT}) \end{bmatrix}^{-1} \begin{bmatrix} \text{Cov}(\text{GAIN}, \text{FI}) \\ \text{Cov}(\text{GAIN}, \text{FAT}) \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

$$\text{EPD}_{\text{RG}} = \text{EPD}_{\text{GAIN}} - b_1 \text{EPD}_{\text{FI}} - b_2 \text{EPD}_{\text{FAT}}$$

Correlations – Efficiency Measures

	RFI ₂	RG ₁	RG ₂
RFI ₁	0.93	-0.51	-0.44
RFI ₂		-0.49	-0.53
RG ₁			0.94

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- ### Summary
- Feed intake, gain... are the root data
 - NCE should analyze root data
 - Data quality
 - Model development
 - Single-trait selection is not advisable
 - Post-NCE analysis required to inform selection decisions
 - Be careful what you wish for...