Economically Relevant Traits and Selection Indices

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**Economically Relevant Traits and Selection Indices**

**Fundamentals**

- $P = G + E$
- Phenotype = Mean + BV + Environment
- There is more than one trait that impacts the profitability of your herd!

**How To Begin?**

- What are my breeding/marketing goals?
- What traits directly impact the profitability of my enterprise?
- Are there environmental constraints?

**Value Discovery of Added Information**

- Many ERTs are not currently evaluated nor collected routinely in the seedstock sector
- However, they drive value downstream
- Reproduction phenotypes (longevity)
- Disease (pulls, treatments, mortality)
- "Routine" carcass data
- Plant value—primal yield, dark cutters, blood splash, etc.

**Indicator Traits**

- Traits that are genetically correlated to an ERT
- Why use indicator traits?
  - Measured earlier in life
  - Cheaper/easier to measure
  - Measured on both sexes
  - Coheritability > heritability of ERT

**Economically Relevant Traits**

- Traits that are directly associated with a revenue stream or a cost
- Examples
  - BWT vs CE
  - REA vs YG
  - YWT vs CWT
  - MWT vs DMI
  - RFI vs FI

**2015 Range Beef Cow Symposium, Loveland, Colo.**
Breed table factor \( A_i \) to add to the EPD for bull of breed \( i \):

\[
A_i = \frac{M_i - M_{Ang}}{b} - \left[ \text{EPD}(i)_{\text{USMARC}} - \text{EPD}(Angus)_{\text{YY}} \right]
\]

\( M_i \) is the weighted average of 2012 EPD of bulls of breed \( i \) having descendants with records at USMARC

\( A_i \) is the coefficient of regression of progeny performance at USMARC on EPD sire

\( b \) is the pooled coefficient of regression of progeny performance at USMARC on EPD sire

\( i \) denotes sire breed

Adapted from Kuehn et al., 2015.

TABLE 1: ADJUSTMENT FACTORS TO ADD TO EPD OF EIGHTEEN DIFFERENT BREEDS TO ESTIMATE AVOID BREED 90%

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\( \text{USMARC}(i) \) is solution for effects of sire breed \( i \) from analysis of USMARC data

\( \text{EPD}(i)_{\text{YY}} \) is the average within-breed 2012 EPD for breed \( i \) for animals born in the base year YY (which is two years before the update)

\( \text{EPD}(i)_{\text{USMARC}} \) is the weighted average of 2012 EPD of bulls of breed \( i \) having descendants with records at USMARC

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**Problem...**

- Correctly accommodating the differences in models used by various beef breed associations
- For CE All breeds use a multi-trait model fitting BWT but some use a linear-linear and some use a threshold-linear
- Some breeds combine categories
- Mean incidence of difficulty (e.g. 50%, 80%, etc.)

**Example**

- Calf survival
- Male fertility
- Disease susceptibility
- Calving ease direct
- Growth rate
- Feed efficiency
- Carcass quality/composition

**Terminal Sires—Traits of Importance**

- Female fertility
- Maternal calving ease
- Maintenance requirements
- Longevity
- Maternal weaning weight (Milk)
- Disease susceptibility
- Adaptation
- Temperament

**Maternal Traits of Importance**
*Tandem Selection
*Independent Culling Levels
*Selection Indices

*Methods of Multiple Trait Selection

—I = a₁ x EPD₁ + a₂ x EPD₂ + aₙ x EPDₙ
*Where a = index weight and n = number of traits

*Economic Index

—*[Dam Weight*Lean Value of Dam + No. Progeny*Progeny Weight*Lean Value of Progeny] - [Dam Feed*Value of Feed for Dam + No. Progeny*Progeny Feed*Value of Feed for Progeny].

*By simply increasing number of progeny per dam through either selection, heterosis from crossing, or better management, we will increase efficiency of production.

*Simulation Framework
*Stochastic Model
*Allows for random variation in multiple traits
*Variation based on fluctuation in historical data
*Simulated base herd
*Multiple iterations

—Economic values from simulation

*Terminal or Maternal?

Terminal
• $B, S$, $S$G (Angus)
• TI (Simmental)
• CHBS (Hereford)
• MTL (Limousin)
• EPI and FPI (Gelbvieh)
• Charolais
• GridMaster (Red Angus)

Maternal
• $W$, $EN$ (Angus)
• API (Simmental)
• BM$S$, BI$S$, CEZ$S$ (Hereford)
• HerdBuilder (Red Angus)
• $Cow$ (Gelbvieh)
*Profitability per exposure
*HerdBuilder
*Bull A 134
*Bull B 110
*30 cows/yr. over 4 yrs. = 120 exposures
*120 exposures X (134-110) =
*$2,880 profit difference
*If you follow the assumptions of the index!

*Improvement in current indices can be made by increasing the number of ERT that have EPD
*Input traits
*Fertility
*Enterprise level profitability should move closer to industry level profitability
*Example: What is the direct economic benefit for a producer to improve tenderness?

*Establish production goals
*Use economic indices that fit your desired breeding objectives
*Do not make sire selection more cumbersome than it needs to be

*Know your costs
*Select on PROFIT not just revenue
*Multiple trait selection is critical and could become more cumbersome
*Economic indexes help alleviate this
*Use index values that meet your breeding objective

*http://beef.unl.edu
*www.beefefficiency.org
*www.nbcec.org
*www.eBEEF.org

*Helpful Resources