Understanding and Applying Economically Relevant Traits (ERT) and Indices for the Commercial Cattle Rancher

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Alternative Perspectives on Beef Production

- Hobby/Life Style/Recreation
- Tax issues
- Profit

Traits that we could select on

- Birth weight
- Calving ease
- Weaning weight
- Milk Production
- Yearling weight
- Scrotal circumference
- Rib fat
- Rib eye area
- % IMF
- Stayability
- Heifer pregnancy rate
- Marbling score
- Carcass weight
- Condition score
- Residual feed intake
- Mature size
- Daughter mature size
- Structural traits
- WDA

The constants across all operations

1. Multiple traits determine profitability
2. Therefore, we need to make genetic progress in multiple traits simultaneously

How do we do this most efficiently?

Two Concepts: One Purpose

Improve profitability through multiple trait selection

Two approaches:

- Economically Relevant Traits
- Selection index

Typical Genetic Evaluation

- Proven
- Accepted
- Well-used

- Assumption:
  - More EPD allow us to better characterize the genetic potential of animals
  - Should be able to make more profitable selection decisions

- But …

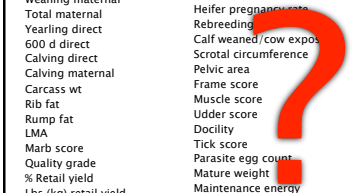
Concept of Economically Relevant Traits

Birth direct
Birth maternal
Weaning direct
Weaning maternal
Total maternal
Yearling direct
600 d direct
Calving direct
Calving maternal
Carcass wt
Rib fat
Rump fat
LMA
Marb score
Quality grade
% Retail yield
Lbs (kg) retail yield
Yield grade
Us LMA
US rib fat
Us % IMF
Fat percentage
Condition score

Gestation length
Days to calving
Calving interval
Stayability
Heifer pregnancy rate
Rebreeding rate
Calf weaned/cow exposed
Scrotal circumference
Pelvic area
Frame score
Muscle score
Udder score
Docility
Tick score
Parasite egg count
Mature weight
Maintenance energy
Feed efficiency
Drop weight
Type score
Uterine score
Tooth score
Precocity score

Feedlot feed consumption
Feedlot surv.
Pre-wean surv.
Serving capacity
Serving proportion
Semen volume
Hip height
Leg score
Length productive life
Doing ability
Grand-maternal weaning
Twinning rate
Days to 11mm BF
Days to 75% Choice
Days to carc wt.
Hair whorl score
Average daily gain
Wt. /day of age
Liver weight
Resting heart rate
Pulmonary arteriole pressure
Brisket disease rate
Bravery
Aggression

Concept of Economically Relevant Traits



Two classes of traits

Terminology

- *Economically Relevant Traits:* traits that are directly associated with a revenue stream or cost of production of a commercial operation.

Terminology

- *Indicator Traits:*
  - Traits that are genetically related to the ERT but are not economically relevant themselves
    - In terms of EPD, they add accuracy to the economically relevant EPD
    - Example: Ultrasound data

Identifying ERT

- Does selecting on a trait **directly** effect your income or cost?
- Birth weight versus Calving Ease
  - If birth weight changes 1 lb, what is the effect on profit?
  - If you assist 1 percent less heifers @ calving, what is the effect on profit?
- What is the value of an additional pound of carcass weight?
  - Not identical across operations:
    - Sell @ weaning versus sell @ harvest

What does that get us?

Birth direct
Birth maternal
Weaning direct
Weaning maternal
Total maternal
Yearling direct
600 d direct
Calving direct
Calving maternal
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Rib fat
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Making replacement selection decisions

- What are the traits that directly influence operation profitability?
  - **Focus selection pressure there!**

Using the concept of ERT will narrow your selection focus

Relative Emphasis is left to the breeder

Economic Selection Index

- What is an index?

Economic Selection Index

$$Index(\$) = v_1 EPD_1 + v_2 EPD_2 + \cdots + v_m EPD_m$$

"V" represents the economic value of each trait

Traits should be economically relevant

Interpreting Selection Index Values

- Interpreted just like an EPD
- It is the ***difference*** between two animal's index value that counts

	Index Value
Bull A	+$40
Bull B	+$10
Difference	**+$30**

How does the commercial producer use an index?

There is a process…

General comments

- Available indexes are "generalized" and use industry average economics and average performance assumptions.
- Economic values are relatively robust
  - Takes a large economic change (cost and income) to greatly influence index rankings
- Index selection works!

New Zealand Beef Cattle example

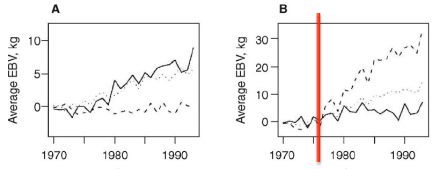

Figure 1. Genetic trends for A) weaning weight direct (—), weaning weight maternal (---), and postweaning BW gain (·····) and B) harvest weight (---), yearling weight (·····), and mature cow BW (—).

Increased profit = $25/head

First step to appropriate use

- Identify your production and marketing system
  - When will the animals be marketed (at what age)?
  - How will the animals be marketed?
  - What is the current performance and genetic level of your herd?

Next step

- Identify index appropriate to the production system just outlined
  - Questions to be addressed
    - What traits are included in the index?
    - *What are the relative economic values used to weight the traits (or at least what data is used to estimate cost of production and value of income sources)*

Traits in the index

- All Purpose Index
  - Cowherd intake
  - Salvage weight
  - Female longevity
  - Milk production
  - Feedlot intake
  - Calf survival
  - Weaning growth
  - Postweaning growth
  - Carcass weight
  - Yield grade
  - Marbling
- Terminal Index
  - ~~Cowherd intake~~
  - ~~Salvage weight~~
  - ~~Female longevity~~
  - ~~Milk production~~
  - Feedlot intake
  - Calf survival
  - Weaning growth
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Traits are different and therefore each index has a different application

- All Purpose Index
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  - Salvage weight
  - Female longevity
  - Milk production
  - Feedlot intake
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What if index doesn't include all of "my" economically relevant traits?

- All Purpose Index
  - Cowherd intake
  - Salvage weight
  - Female longevity
  - Milk production
  - Feedlot intake
  - Calf survival
  - Weaning growth
  - Postweaning growth
  - Carcass weight
  - Yield grade
  - Marbling
- Example
  - Heifer pregnancy
  - *Calving Ease*
- Solution
  - Must apply selection pressure to that trait independently

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Another example: Cow Energy Index (AAA)

- Includes
  - Mature cow size
  - Milk production (lactation requirements)
- Can account for differences in feed costs of cows, but would need to apply additional selection pressure to other economically relevant traits
- Could alternatively use the "$Wean Index"

- Identify your production and marketing system
  - When will the animals be marketed (at what age)?
  - How will the animals be marketed?
  - What is the current performance and genetic level of your herd?
- Identify index appropriate to the production system outlined
  - Questions to be addressed
    - What traits are included in the index?
    - What are the relative economic values used to weight the traits (or at least what data is used to estimate cost of production and value of income sources)
- Decide on the appropriate index for evaluation based on the most similarity between points 1 and 2.

Last step: Long term perspective

- Evaluate index based on past performance and economic data
  - (often difficult, so is listed as "optional")

Conclusions

- Two approaches to profitable replacement selection decisions
  - Focus solely on the economically relevant traits (ERT)
    - Use the EPD for those, and indicators when EPD are not available
  - Economic selection indexes
    - Identify index most in line with your production system
    - If traits are not included in index, apply selection pressure to those independently