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Economically Relevent Traits and Selection Indcies

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*ECONOMICALLY RELEVENT TRAITS AND SELECTION INDCIES

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*P=G+E
*Phenotype = Mean + BV + Environment

*There is more than one trait that impacts the profitability of your herd!

*Fundamentals

*What are my breeding/marketing goals?

*What traits directly impact the profitability of my enterprise?

*Are there environmental constraints?

*How To Begin?

*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

*Economically Relevant Traits

*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.

*Value Discovery of Added Information

*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

*Indicator Traits

* Across Breed EPD

Breed table factor (A_i) to add to the EPD for bull of breed i

$$M_i = USMARC(i)/b + [EPD(i)_{YY} - EPD(i)_{USMARC}]$$

$$A_i = (M_i - M_{Angus}) - (EPD(i)_{YY} - EPD(Angus)_{YY})$$

USMARC(i) is solution for effects of sire breed i from analysis of USMARC data

$EPD(i)_{YY}$ 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)

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

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

i denotes sire breed i

TABLE 1: ADJUSTMENT FACTORS TO ADD TO EPDs OF EIGHTEEN DIFFERENT BREEDS TO ESTIMATE ACROSS BREED EPDs

Breed	Birth Wt. (lb)	Weaning Wt. (lb)	Yearling Wt. (lb)	Maternal Milk (lb)	Marbling Score*	Ribeye Area (in^2)	Fat Thickness (in)	Carcass Wt.(lb)
Angus	0.0	0.0	0.0	0.0	0.00	0.00	0.000	0.0
Hereford	2.7	-4.4	-26.6	-17.8	-0.32	-0.10	-0.053	
Red Angus	3.4	-25.7	-30.9	2.4	-0.32	0.03	-0.023	-6.2
Shorthorn	5.1	-30.7	-12.3	4.6	-0.24	0.31	-0.107	-11.6
South Devon	3.6	-8.0	-25.9	2.4	-0.09	0.21	-0.129	-22.3
Beefmaster	5.7	36.1	32.3	11.9				
Brahman	10.9	47.5	9.2	23.6	-0.83	-0.11	-0.146	-28.5
Brangus	3.9	13.9	5.1	4.6				-12.5
Santa Gertrudis	6.9	41.4	42.2	14.2	-0.62	-0.06	-0.097	-5.4
Braunvieh	2.5	-22.1	-49.3	-0.4				-44.9
Charolais	8.6	39.6	40.8	7.3	-0.39	0.98	-0.207	5.4
Chiangus	3.5	-26.9	-38.8	0.2	-0.40	0.34	-0.114	-20.9
Gelbvieh	2.7	-21.5	-30.4	1.6	-0.33	0.65	-0.117	-22.6
Limousin	3.0	-17.0	-42.0	-8.8	-0.60	0.98		-13.4
Maine-Anjou	5.0	-24.5	-35.0	-3.6	-0.60	0.78	-0.192	-23.6
Salers	2.2	-4.1	-26.3	4.9	-0.14	0.85	-0.203	-29.7
Simmental	3.6	-4.8	-9.5	3.6	-0.38	0.43	-0.137	3.8
Tarentaise	3.1	28.3	9.6	23.4				

*Marbling score units: 4.00 = Sl^{00}; 5.00 = Sm^{00}

Adapted from Kuehn et al. , 2015.

Simm. Bull act EPD	1.0	60.0	100.0	25.0
Simm. Adj.	+3.6	-4.8	-9.5	+3.6
	4.6	55.2	90.5	28.6
Heref. Bull act EPD	2.3	55.0	90.0	25.0
Heref Adj.	+2.7	-4.4	-26.6	-17.8
	5.0	50.6	63.4	7.2

* Example

*Problem…

- *Scaling of threshold traits
  - *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.)

- *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

*Methods of Multiple Trait Selection

*Tandem Selection

*Independent Culling Levels

*Selection Indices

INDEPENDENT CULLING LEVELS

CED = 2.1 WW = 43 MM = 18 SC = 0.9 IMF = 0.04

	CED	WW	MM	SC	IMF	$BMI
1	2.5	55	20	1.0	0.10	20.16
2	5.0	50	25	1.2	-0.10	19.55
3	4.0	45	20	1.0	0.25	20.35
4	1.6	62	19	1.0	0.20	21.64

Moser, 2005

*Economic Index

*$I = a_1 \times EPD_1 + a_2 \times EPD_2 + a_n \times EPD_n$

*Where a = index weight and n = number of traits

*Improving Efficiency

*[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

$b=P^{-1}Gv$

Economic values from simulation

*Terminal or Maternal?

Terminal
- $B, $F, $G (Angus)
- TI (Simmental)
- CHB$ (Hereford)
- MTI (Limousin)
- EPI and FPI (Gelbvieh)
- Charolais
- GridMaster (Red Angus)

Maternal
- $W, $EN (Angus)
- API (Simmental)
- BMI$, BII$, CEZ$ (Hereford)
- HerdBuilder (Red Angus)
- $Cow (Gelbvieh)

*Example

- *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?

*Summary

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

*Summary

- 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

*Helpful Resources

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