Sire Selection Basics: Getting ready to buy your next bull

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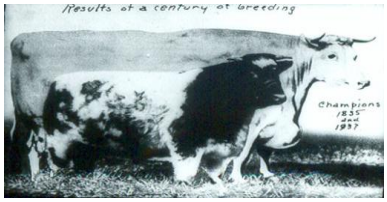
Current Status=Confusion

	CE	BW	WW	YW	MCE	MM	MWW
Adj.		90	700	1320			
Ratio		101	107				
EPD	9	-1.0	25	49	3	11	23
Acc	.29	.37	.30	.27	.18	.19	.23

	YG	Marb	BF	REA
Adj.		4.65%	.23	12.5
Ratio		106	100	95
EPD	.21	.44	.05	-.39
Acc	.32	.31	.33	.34

RFI	TEND	MARB
7	6	8



Fundamentals

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

- 600= 550 + 10 +40
- 600=550 + (-5) + 55

Raw data

- Includes all sources of variation
  - Management (i.e. feed)
  - Differences in age
  - Sex
  - Age of dam
  - Climate
  - Genetics

Adjusted data

- What are they 'adjusted' for?
  - Sex
  - Age
  - Age of dam
- Why?
  - Compare 'apples to apples'

Ratios

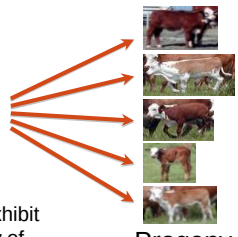
- A way of comparing animals within a contemporary group
  - Contemporary group average = 500
  - Animal = 550
  - Ratio = 110
    - (550/500)*100
- Why not outside of that group?
  - Different environmental influences
  - Group averages may not be equal

EPDs

- Expected Progeny Difference
- Separates the 'wheat from the chaff'
- What information is included?
  - Pedigree information (Parental and collateral relatives)
  - Individuals' own record
  - Progeny information
  - Can be used across herds but only within a breed

Performance of the Progeny

Sire



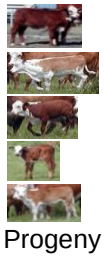
+30 lb
+15 lb
-10 lb
+ 5 lb
+10 lb
+10 lb

Progeny

Offspring of one sire exhibit more than ¾ diversity of the entire population

We learn about parents from progeny

Sire



+30 lb
+15 lb
-10 lb
+ 5 lb
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+10 lb

Progeny

Sire EPD +8 lb

(EPD is "shrunk")

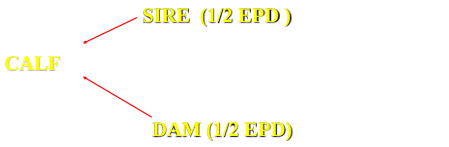
EPDs on widely-used old sires are accurate

Sire

With enough progeny, this is usually close to the bulls true EPD

Sire EPD +8 lb

Pedigree estimate EPDs



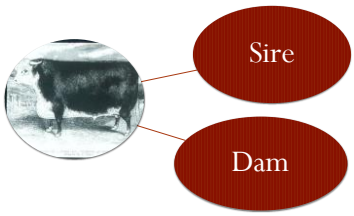
Pedigree Est. EPD = 1/2 Sire EPD + 1/2 Dam EPD

Individual record

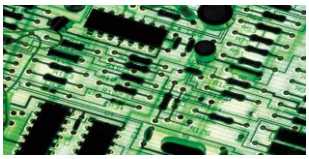
$EPD_I = (0.5*EPD_S) + (0.5*EPD_D) + (0.5 *Mendelian\ Sampling\ Effect)$

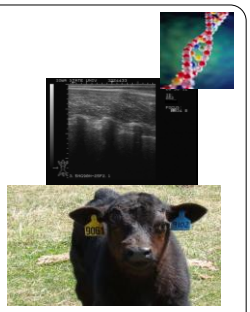
See Beef Improvement Federation Guidelines

Mating—Passing of Alleles



Mendelian Sampling





Accuracy

- EPDs are estimates
  - Accuracy tells use how close the estimate is to the true value
- NOT a measure of progeny variability
- IS a measure of how much an EPD could change
  - Way of quantifying risk
- Increases with additional data

Possible Change

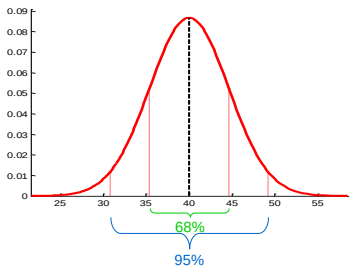
- Values are standard deviations
- Possible change = standard error of prediction (SEP)
- Low accuracy means larger possible change values
- Not static
  - Different for each breed, trait, and could differ between evaluations

Accuracy Example

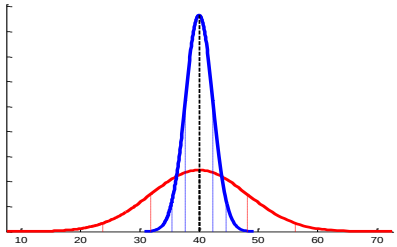
Weaning Wt. EPD = 40
ACC. = 0.60

Possible change +/- 4.60

68% confident his true EPD is between 35.4 and 44.6



Confidence Intervals for EPD = 40, Acc = 0.60, SEP = 4.6



Difference in EPD Accuracy

Acc = 0.30, Possible Change = 8.1
Acc = 0.8, Possible Change = 2.3

Accuracy

Table 1. Approximate number of progeny needed to reach accuracy levels (true (r) and the BIF standard) for three heritabilities (h^2).

Accuracy		Heritability Levels		
r	BIF	h^2 (0.1)	h^2 (0.3)	h^2 (0.5)
0.1	0.01	1	1	1
0.2	0.02	2	1	1
0.3	0.05	4	2	1
0.4	0.08	8	3	2
0.5	0.13	13	5	3
0.6	0.2	22	7	4
0.7	0.29	38	12	7
0.8	0.4	70	22	13
0.9	0.56	167	53	30
0.999	0.99	3800	1225	700

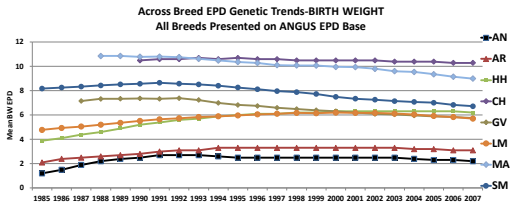
MBV BIF Accuracy

Genetic Correlation	% GV	BIF Accuracy
0.1	1	0.005
0.2	4	0.020
0.3	9	0.046
0.4	16	0.083
0.5	25	0.132
0.6	36	0.2
0.7	49	0.286

Percentile Rank

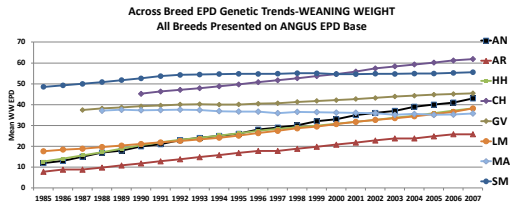
- Locates a bulls EPD relative to other bulls in the breed.
- EPD at upper 25th percentile
  - 24 out of 100 bulls better
  - 75 out of 100 bulls worse
- Easy way to evaluate the where bull ranks in breed
- Use Non-Parent percentiles for yearlings
- Measure of 'extremeness'
- Record breed averages in your Red Book!

BW EPD
Genetic Trends



Weaber and Fennewald, 2009

WW EPD
Genetic Trends



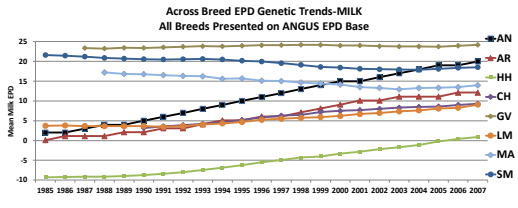
Weaber and Fennewald, 2009

Growth—Related to Mature Size

	BW	WW	YW
MW	0.57	0.62	0.45

Northcutt and Wilson, 1993

MILK EPD
Genetic Trends



Weaber and Fennewald, 2009

Webster

- Optimum
- **1:** the amount or degree of something that is most favorable to some end; *especially* **:** the most favorable condition for the growth and reproduction of an organism
- **2:** greatest degree attained or attainable under implied or specified conditions

Economic Efficiency

	Low	Med.	High
Income			
Weaning	496.40	493.60	501.10
Slaughter	810.1	808.40	789.40
Expense			
Weaning	549.80	553.40	568.80
Slaughter	814.20	837.50	828.30
Econ. Eff.			
Weaning	90.3	89.2	88.1
Slaughter	99.5	96.5	95.3

Why is multiple trait selection...

- Difficult?
  - Lots of EPDs
  - Some for Economically Relevant Trait (ERT) some for Indicator Traits
- Important?
  - More than one trait is important for enterprise, operation or industry profitability

Economic Index Values

- Method of multiple trait selection on aggregate merit
- Collection of EPDs multiplied by economic values
- A particular index represents EPDs relevant to a breeding objective
  - i.e. retained ownership and sell on a grid
- No accuracy values
- But they can change!

Selection Index

- Two Step approach by Henderson (1950s)
  - Calculate predictions of merit (EPD) for each trait in selection objective
  - Weight each prediction by it's Relative Economic Value (REV)
- Equivalent to Hazel approach

$$H = a_1 EPD_1 + a_2 EPD_2 + \ldots + a_n EPD_n$$

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

2/5/2009

Using Selection Indexes

- Use your marketing endpoint to guide you to 'right' index
- Apply independent culling levels to EPDs you know limit production in your environment (CED, MILK)
- Limit use of other EPDs in selection criteria (decreases selection pressure)
- Use $Index to guide you to the bull with the most optimal combination of traits
- Use $Index just like other EPDs

Heterosis

- Hybrid Vigor
- Superiority of a crossbred animal as compared to the average of its straightbred parents
- More divergent parental lines = more heterosis
- NOT available from within breed matings

Inversely related

Trait	Heritability	Heterosis
Reproduction (fertility)	Low	High
Production (growth)	Moderate	Moderate
Product (carcass)	High	Low

MARC data

Breed	Birth wt.	Weaning wt.	Yearling wt.	Milk
Angus	0.0	0.0	0.0	0.0
Charolais	8.5	40.1	48.9	4.6
Gelbvieh	3.8	3.9	-10.4	10.2
Hereford	2.8	-1.5	-17.1	-18.7
Limousin	3.6	0.9	-31.3	-13.4
Red Angus	2.3	-1.5	-8.7	-1.5
Saler	2.0	-0.3	-10.5	0.5
Shorthorn	5.9	17.9	41.7	19.6
Simmental	4.8	25.9	24.5	15.3

Adapted from Kuehn et al. , 2011.

Determining biological types

Simm. Bull act EPD	2.3	34.0	57.0	6.0
Simm. Adj.	+4.8	+25.9	+24.5	+15.3
	7.1	59.9	81.5	21.3
Heref. Bull act EPD	3.8	35.0	60.0	13.0
Heref Adj.	+2.8	-1.5	-17.1	-18.7
	6.6	33.5	42.9	-5.7
Diff	0.5	26.4	38.6	27.0

Making sense of it all

- Concentrate on Economically Relevant Traits (ERTs)
- Understand the differences between sources of information
- Know that EPDs and Economic Index values are more valuable than actual records or ratios
  - EPD 7-9 times more effective in generating response to selection than actual measurements

Remember the fundamentals

- Animals Record = His/her genetics + the environment
  - Phenotype = genotype + environment
- What can be passed on?
  - Bull's actual record?
  - The environment?
  - Bull's genetics?
    - Then why not use the tools that measure only this?