Bull Selection Exercise

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Breeding Objectives

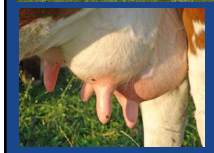
- Goals for your operation that are influenced by genetics
- Must take into account market, management and environment
- Use selection tools and breeding program to meet objectives

Factors Affecting Bull Selection: Fitting your Bull to Market, Management and Environment

Define Your End Product

- Market
  - When?
  - How?
- Replacements
  - Retain?
  - Purchase?

What factors will affect your product?



- Weight
- Milking Ability
- Color
- Frame
- Conformation
- Carcass

Evaluate the Cow Herd

- Available data
  - reproduction
  - performance
  - carcass
- Size
  - frame
  - weight

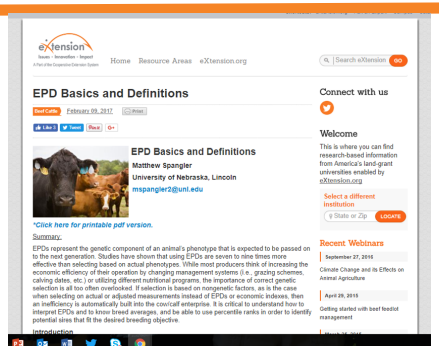
Assessing Management

- What resources are available?
  - Labor
  - Nutrition

Nutrition

- Forage Base
- Stored Feeds
- Purchased Feeds

EPD Basics and Definitions



http://articles.extension.org/pages/73314/epd-basics-and-definitions#

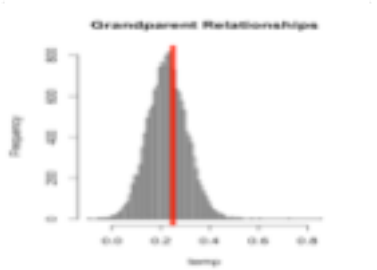
Own performance is included in EPDs

- An animal's **own performance** is combined and properly weighted, along with the performance of relatives (progeny, parents, grandparents, full and half-siblings, etc.), and all genetic relationships to generate an EPD
- EPDs are the best estimate we have of how a bull or cow's future progeny will perform, on average compared to another bull/cow (or the breed average) for a given trait.
- Many producers mistakenly place emphasis on raw measurements or adjusted phenotypes
- It has been shown that selection based upon EPDs is 5-9 times more accurate than selection based upon index performance & ratios.

"Sharing" of information--relatedness

- Animals are related through pedigree and genomic relatedness
  - Phenotypes collected on an animal can benefit the prediction of EPD on related animals.
  - Think parent/offspring
  - Think sex-limited traits
  - As the relationship decreases between animals, so does the amount of information that is shared.

Understand relationships among animals



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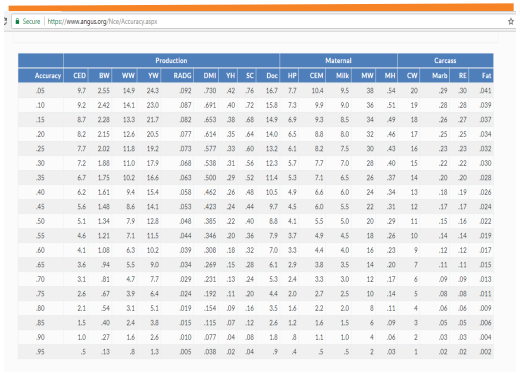
"Sharing" of information--correlations

- Traits are genetically correlated with each other
  - Early growth traits (BWT, WWT) are correlated to YWT
  - Genetic predictions of YWT are possible by just having early growth measures
  - Think growth and feed intake
  - As the genetic correlation decreases between traits, so does the amount of information that is shared.

Accuracy and Associated Possible Change



	Production									Maternal				Carcass			
Accuracy	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	HP	CEM	Milk	MW	MH	CW	Marb	RE	Fat
.05	9.7	2.55	14.9	24.3	.092	.730	.42	.76	16.7	7.7	10.4	9.5	.38	.54	20	.29	.30	.041
.10	9.2	2.42	14.1	23.0	.087	.691	.40	.72	15.8	7.3	9.9	9.0	.36	.51	19	.28	.28	.039
.15	8.7	2.28	13.3	21.7	.082	.653	.38	.68	14.9	6.9	9.3	8.5	.34	.49	18	.26	.27	.037
.20	8.2	2.15	12.6	20.5	.077	.614	.35	.64	14.0	6.5	8.8	8.0	.32	.46	17	.25	.25	.034
.25	7.7	2.02	11.8	19.2	.073	.577	.33	.60	13.2	6.1	8.2	7.5	.30	.43	16	.23	.23	.032
.30	7.2	1.88	11.0	17.9	.068	.538	.31	.56	12.3	5.7	7.7	7.0	.28	.40	15	.22	.22	.030
.35	6.7	1.75	10.2	16.6	.063	.500	.29	.52	11.4	5.3	7.1	6.5	.26	.37	14	.20	.20	.028
.40	6.2	1.61	9.4	15.4	.058	.462	.26	.48	10.5	4.9	6.6	6.0	.24	.34	13	.18	.19	.026
.45	5.6	1.48	8.6	14.1	.053	.423	.24	.44	9.7	4.5	6.0	5.5	.22	.31	12	.17	.17	.024
.50	5.1	1.34	7.9	12.8	.048	.385	.22	.40	8.8	4.1	5.5	5.0	.20	.29	11	.15	.16	.022
.55	4.6	1.21	7.1	11.5	.044	.346	.20	.36	7.9	3.7	4.9	4.5	.18	.26	10	.14	.14	.019
.60	4.1	1.08	6.3	10.2	.039	.308	.18	.32	7.0	3.3	4.4	4.0	.16	.23	9	.12	.12	.017
.65	3.6	.94	5.5	9.0	.034	.269	.15	.28	6.1	2.9	3.8	3.5	.14	.20	7	.11	.11	.015
.70	3.1	.81	4.7	7.7	.029	.231	.13	.24	5.3	2.4	3.3	3.0	.12	.17	6	.09	.09	.013
.75	2.6	.67	3.9	6.4	.024	.192	.11	.20	4.4	2.0	2.7	2.5	.10	.14	5	.08	.08	.011
.80	2.1	.54	3.1	5.1	.019	.154	.09	.16	3.5	1.6	2.2	2.0	.8	.11	4	.06	.06	.009
.85	1.5	.40	2.4	3.8	.015	.115	.07	.12	2.6	1.2	1.6	1.5	.6	.09	3	.05	.05	.006
.90	1.0	.27	1.6	2.6	.010	.077	.04	.08	1.8	.8	1.1	1.0	.4	.06	2	.03	.03	.004
.95	.5	.13	.8	1.3	.005	.038	.02	.04	.9	.4	.5	.5	.2	.03	1	.02	.02	.002

Possible Change Example

- 68% Confidence Intervals
  - EPD ± 1*PC
  - WW EPD = 40, Acc = 0.60, PC = 6.3
  - 68% CI = 40 ± 6.3 = (33.7, 46.3)
- 95% Confidence Intervals
  - EPD ± 1.96*PC
  - 95% CI = 40 ± 1.96*6.3 = (27.65, 52.35)

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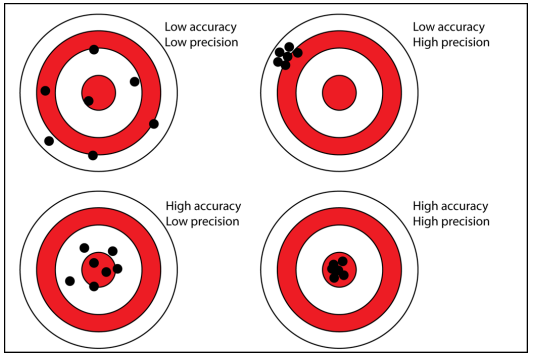
Accuracy is not precision

- Accuracy gives a measure of how closely related the EPD and TPD are to each other.
- Mendelian sampling gives rise to progeny variation.
- Variation is not a bad thing, particularly if you are a seedstock producer



We don't milk beef cows (by design)

- "Milk" EPD is actually maternal weaning weight.
- Several traits have maternal components
  - Birth weight, calving ease
- Reported in pounds of weaning weight of calf.
- It is the portion of weaning weight variability that we can attribute to a female's maternal genetics.
  - Maternal genetics is largely her lactation potential.

Economic Efficiency

van Oijen et al. (1993)

	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

What is the most important trait?

PROFIT

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What Information Do You Need?

12 J DOMINO 38 1E {DLF,HYF,IEF}
— Calved: March 27, 2013 — Tattoo: BE 38

BW	WW	YW	MM	M&G	BMI$	CHE$
4.7	58	91	30	59	19	30

Lot	Performance EPDs					Carcass EPDs				$ Index	Pedigree
	Percentile Rank in the Breed										
	CED	BW	WW	YW	RADG	Milk	Marb	RE	SW	SB	FG	$Profit
5	11	.8	58	102	.20	34	1.19	.78	$63	$134	-14	$16406
	15%	40%	15%	15%	60%	2%	3%	20%	10%	15%	32%	1%

Tattoo	DOB	Reg #	C. Ease	Growth	Carcass	Maternal	Genomic	Herd
8414C	9/10/15	18484014	***	****	*****		GGPLD	MCC

Here is one of the highest $Profit bulls in the sale. We invested in the $Profit genetic evaluaiton in order to get multi-breed EPDs for all traits including feed efficiency and $Profit. The AAA database & EPDs are excellent. We just want to get a 3rd Party genetic evaluation that will compare all o f our breeds on the same database. $Profit is a great tool to use for selecting the most profitable cattle. If you need growth & marbling this calving ease bull should do the trick. 5 generations of Carcass genetics!

G A R PROGRESS
G A R ADVANCE
G A R 5050 NEW DESIGN A84
BROWN-MCC ADVANCE 8414C
B/R NEW DAY 454
G A R NEW DAY A1044
G A R OBJECTIVE 1056
G A R PREDESTINED
G A R OBJECTIVE 2345
G A R NEW DESIGN 5050
G A R OBJECTIVE A655
BOYD NEW DAY 8005
B/R RUBY 1224
S S OBJECTIVE T510 0T26
G A R PRECISION 1142

Economic Selection Indexes

- EPDs are expressed in Pounds, Percentages, Centimeters, etc.
- Economic Selection Indexes are expressed in Dollars
- Combination of EPDs in which each trait is weighted by its economic importance

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What is a selection index?

$$SI = a_1*EPD_1 + a_2*EPD_2 + a_1*EPD_1 \ldots + a_i*EPD_i$$

a_i = Economic Weighting for Trait i ($/unit)

EPD_i = Expected Progeny Difference for Trait i

SI difference is expected dollar value difference per calf

Example

SI = 2*CED + 1.5*WW + .25*Milk

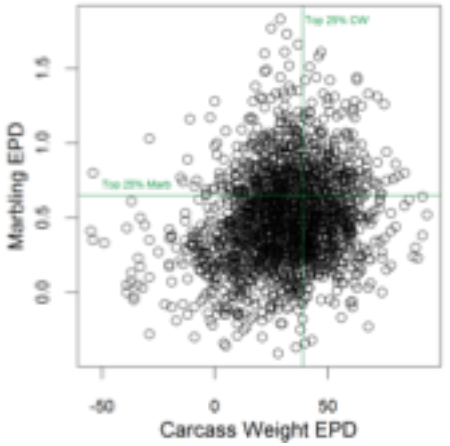
Bull A	Bull B
CED = 7	CED = 10
WW = 44	WW = 35
Milk = 12	Milk = 14
SI = $83	SI = $76

Bull A has $7/calf increased value

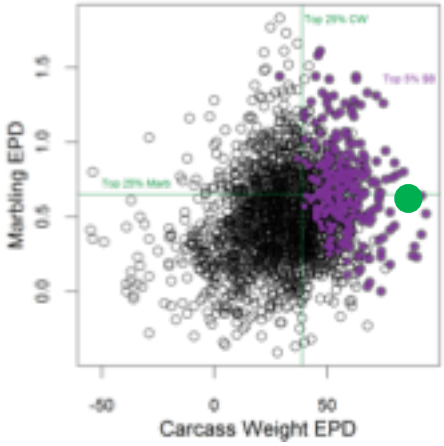
Why Selection Indices?

- Profit Motivated
- Breeding Objectives Compatible
- Multi-trait Selection
- Simple

Truncation selection



Economic index selection



What is Available

- Terminal Index
- Weaning/Replacement Index
- All-Purpose Index

Terminal Index

- Income based on carcass merit
- No replacements retained

Terminal Index

- Income based on carcass merit
- No replacements retained
- Caution – most place little to no emphasis on calving ease
- Intake is component of many, but not all

Weaning/Replacement Index

- Targeted for commercial cow/calf cattlemen
- Calves marketed at weaning
- Replacement heifers are retained

Weaning/Replacement Index

- Targeted for commercial cow/calf cattlemen
- Calves marketed at weaning
- Replacement heifers are retained
- Calving ease is considered, but may not be adequate if large numbers of heifers are to be bred
- Limited influence of reproductive performance
- Limited influence of cow maintenance
- Little emphasis on calving ease maternal

All-Purpose Index

- Income primarily based on carcass merit
- Replacement heifers are retained

All-Purpose Index

- Income primarily based on carcass merit
- Replacement heifers are retained
- Calving ease emphasis varies
- Limited information on feed efficiency/intake
- Limited information on cow maintenance
- Varying levels of information on reproductive performance

Keys to Successful Implementation

- Develop breeding objectives
  - Management
  - Marketing
  - Environment
- Identify selection index that most closely matches your breeding objectives
- Be cautious of traits, included in the index, that do not have an economic (income/cost) value to your production system
- Do not panic if market values change; selection indices are robust

Keys to Successful Implementation

- Identify traits of economic importance to your production system that are not in the index and select for those traits in tandem with the SI
- Realize some traits in an index have thresholds or optimum is not maximum
  - Calving Ease
  - Milking Ability

Take Home Messages!

- **Selection indices are simple to use, facilitate genetic improvement in profitability, available for major production/marketing systems**
- **Know what's under the hood – What traits are included? Is calving ease acceptable for my intended use? Do I need to select for or monitor additional traits?**
- **Selection indices are robust even in changing markets and varying production/marketing systems**

Selection and Mating Decisions

- Commercial cattlemen SHOULD care about BOTH additive and non-additive effects.
  - Selection index/EPDs
  - Hybrid vigor or heterosis
- Seedstock producers SHOULD focus on additive genetic merit, and putting it in a package that helps clientele exploit non-additive effects.

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Advantages of Separating Breeding Decisions- Maternal v. Terminal

- Focus objectives
- Increase sale weight of calves
- Decrease calving assistance
- Requires a clear breeding objective
- Requires use of multiple breeds

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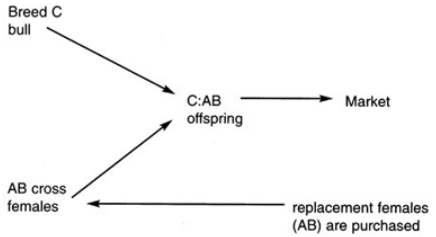
Three breed terminal



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Advantages of the crossbred calf

Trait	Observed Improvement	% Heterosis
Calving rate	3.2	4.4
Survival to weaning	1.4	1.9
Birth weight	1.7	2.4
Weaning weight	16.3	3.9
ADG	0.08	2.6
Yearling weight	29.1	3.8

Adapted from Cundiff and Gregory, 1999

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Advantages of the crossbred cow

Trait	Observed Improvement	% Heterosis
Longevity	1.36	16.2
Cow Lifetime Production:		
No. Calves	0.97	17.0
Cumulative Wean. Wt., lb.	600	25.3

Adapted from Cundiff and Gregory, 1999.

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Retained Heterosis

- 1/2 Simmental 1/2 Angus bull mated to 1/2 Simmental 1/2 Angus cows
  - 1-[(1/2*1/2)+(1/2*1/2)]=.5 or 50%
- 1/2 Limousin 1/2 Angus bull mated to Angus cows
  - 1-[(1/2*0)+(1/2*1)]=.5 or 50%

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Crossing Systems Compared

	Advantage WW/cow exp.	Retained heterosis
A*B*C rotation	20	86
T*(A*B)	24	100
F1 Bulls		
A*BxA*B	12	50
A*BxA*C	16	67
A*BxC*D	19	83

Adapted from Ritchie et al., 1999 ; Gregory and Cundiff 1980.

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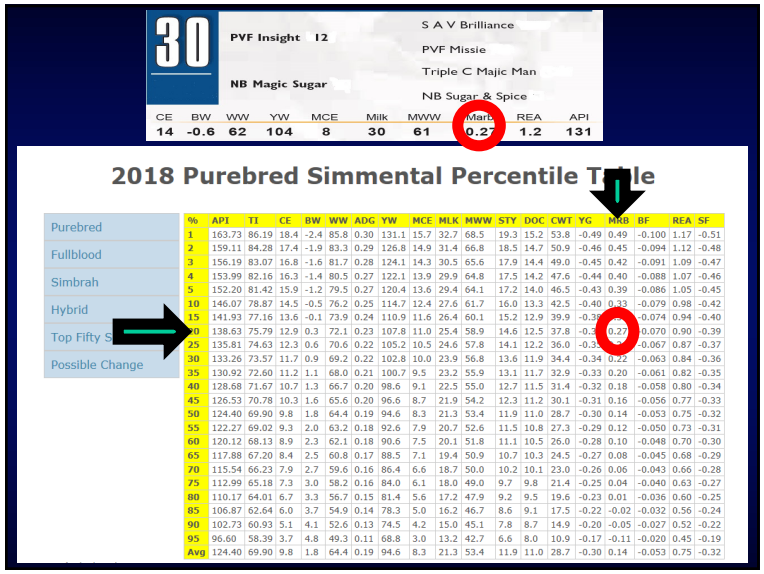

%	API	TI	CE	BW	WW	ADG	YW	MCE	MLK	MWW	STY	DOC	CWT	YG	MRB	BF	REA	SF
1	163.73	86.19	18.4	-2.4	85.8	0.30	131.1	15.7	32.7	68.5	19.3	15.2	53.8	-0.49	0.49	-0.100	1.17	-0.51
2	159.11	84.28	17.4	-1.9	83.3	0.29	126.8	14.9	31.4	66.8	18.5	14.7	50.9	-0.46	0.45	-0.094	1.12	-0.48
3	156.19	83.07	16.8	-1.6	81.7	0.28	124.1	14.3	30.5	65.6	17.9	14.4	49.0	-0.45	0.42	-0.091	1.09	-0.47
4	153.99	82.16	16.3	-1.4	80.5	0.27	122.1	13.9	29.9	64.8	17.5	14.2	47.6	-0.44	0.40	-0.088	1.07	-0.46
5	152.20	81.42	15.9	-1.2	79.5	0.27	120.4	13.6	29.4	64.1	17.2	14.0	46.5	-0.43	0.39	-0.086	1.05	-0.45
10	146.07	78.87	14.5	-0.5	76.2	0.25	114.7	12.4	27.6	61.7	16.0	13.3	42.5	-0.40	0.33	-0.079	0.98	-0.42
15	141.93	77.16	13.6	-0.1	73.9	0.24	110.9	11.6	26.4	60.1	15.2	12.9	39.9	-0.38	0.30	-0.074	0.94	-0.40
20	138.63	75.79	12.9	0.3	72.1	0.23	107.8	11.0	25.4	58.9	14.6	12.5	37.8	-0.37	0.27	-0.070	0.90	-0.39
25	135.81	74.63	12.3	0.6	70.6	0.22	105.2	10.5	24.6	57.8	14.1	12.2	36.0	-0.35	0.25	-0.067	0.87	-0.37
30	133.26	73.57	11.7	0.9	69.2	0.22	102.8	10.0	23.9	56.8	13.6	11.9	34.4	-0.34	0.22	-0.063	0.84	-0.36
35	130.92	72.60	11.2	1.1	68.0	0.21	100.7	9.5	23.2	55.9	13.1	11.7	32.9	-0.33	0.20	-0.061	0.82	-0.35
40	128.68	71.67	10.7	1.3	66.7	0.20	98.6	9.1	22.5	55.0	12.7	11.5	31.4	-0.32	0.18	-0.058	0.80	-0.34
45	126.53	70.78	10.3	1.6	65.6	0.20	96.6	8.7	21.9	54.2	12.3	11.2	30.1	-0.31	0.16	-0.056	0.77	-0.33
50	124.40	69.90	9.8	1.8	64.4	0.19	94.6	8.3	21.3	53.4	11.9	11.0	28.7	-0.30	0.14	-0.053	0.75	-0.32
55	122.27	69.02	9.3	2.0	63.2	0.18	92.6	7.9	20.7	52.6	11.5	10.8	27.3	-0.29	0.12	-0.050	0.73	-0.31
60	120.12	68.13	8.9	2.3	62.1	0.18	90.6	7.5	20.1	51.8	11.1	10.5	26.0	-0.28	0.10	-0.048	0.70	-0.30
65	117.88	67.20	8.4	2.5	60.8	0.17	88.5	7.1	19.4	50.9	10.7	10.3	24.5	-0.27	0.08	-0.045	0.68	-0.29
70	115.54	66.23	7.9	2.7	59.6	0.16	86.4	6.6	18.7	50.0	10.2	10.1	23.0	-0.26	0.06	-0.043	0.66	-0.28
75	112.99	65.18	7.3	3.0	58.2	0.16	84.0	6.1	18.0	49.0	9.7	9.8	21.4	-0.25	0.04	-0.040	0.63	-0.27
80	110.17	64.01	6.7	3.3	56.7	0.15	81.4	5.6	17.2	47.9	9.2	9.5	19.6	-0.23	0.01	-0.036	0.60	-0.25
85	106.87	62.64	6.0	3.7	54.9	0.14	78.3	5.0	16.2	46.7	8.6	9.1	17.5	-0.22	-0.02	-0.032	0.56	-0.24
90	102.73	60.93	5.1	4.1	52.6	0.13	74.5	4.2	15.0	45.1	7.8	8.7	14.9	-0.20	-0.05	-0.027	0.52	-0.22
95	96.60	58.39	3.7	4.8	49.3	0.11	68.8	3.0	13.2	42.7	6.6	8.0	10.9	-0.17	-0.11	-0.020	0.45	-0.19
Avg	124.40	69.90	9.8	1.8	64.4	0.19	94.6	8.3	21.3	53.4	11.9	11.0	28.7	-0.30	0.14	-0.053	0.75	-0.32