




Traits and Tools for Retention and Replacement of Females

Megan Rolf
State Beef Extension Specialist




OKLAHOMA STATE BEEF EXTENSION



OKLAHOMA STATE BEEF EXTENSION

Overview

- Traits for replacement female selection
 - Breeding Objectives
 - Optimization of performance
 - Fit to environment
 - Genetic Selection Tools



OKLAHOMA STATE BEEF EXTENSION




What Does the Ideal Cow Look Like?





Different for Everyone!

OKLAHOMA STATE BEEF EXTENSION



The Ideal Cow

- Early Sexual Maturity
- High Reproductive Rate
- Low Rate of Dystocia
- Longevity
 - Genetics/crossbreeding and management
- Minimum Maintenance Requirements
 - Size!
- Ability to convert forage to lbs. of calf
 - Fit to Environment!

Dickerson, 1970

OKLAHOMA STATE BEEF EXTENSION



There are How Many?

- Some breeds have up to 25 EPDs/Indexes on each animal!
- Not to mention ratios and sound data

Breed	Growth																											
	Birth Weight	Weaning Weight	1g Weight	2g Weight	3g Weight	4g Weight	5g Weight	6g Weight	7g Weight	8g Weight	9g Weight	10g Weight	11g Weight	12g Weight	13g Weight	14g Weight	15g Weight	16g Weight	17g Weight	18g Weight	19g Weight	20g Weight	21g Weight	22g Weight	23g Weight	24g Weight	25g Weight	
Angus	x																											
Blonde d'Aquitaine	x																											
Beefmaster	x																											
Brahman	x																											
Brangus	x	x																										
Braford	x	x																										
Braunvieh	x	x																										
Charolais	x	x																										
Chianina	x	x																										
Gelbvieh	x	x																										
Hereford	x	x																										
Limousin	x	x	x																									
Maine-Anjou	x	x	x	x																								
Red Angus	x	x	x	x																								
Red Brangus	x	x	x	x																								
Romagnola	x	x																										
Salers	x	x																										
Santa Gertrudis	x	x																										
Senepol	x	x																										
Shorty	x	x	x																									
Simmental	x	x	x	x																								
Tarentaise	x	x	x	x																								

This is why we need breeding objectives!



OKLAHOMA STATE BEEF EXTENSION



Breeding Objectives

- Allows easy identification of areas to place selection intensity
 - Mission statement
 - Defines a direction!
- Most important things to ascertain
 - What do we do well?
 - What needs improvement?
 - Where can I increase profit?
 - Terminal or keeping replacements?
 - What inputs are available (labor, forage, grain, etc.)
 - Fit to the environment (What traits/inputs are limiting)



OKLAHOMA STATE BEEF EXTENSION

Fit the Environment

- Optimize for environment and resources
 - Milk Production
 - Mature Weight
 - Calving Ease

MAXIMIZE?

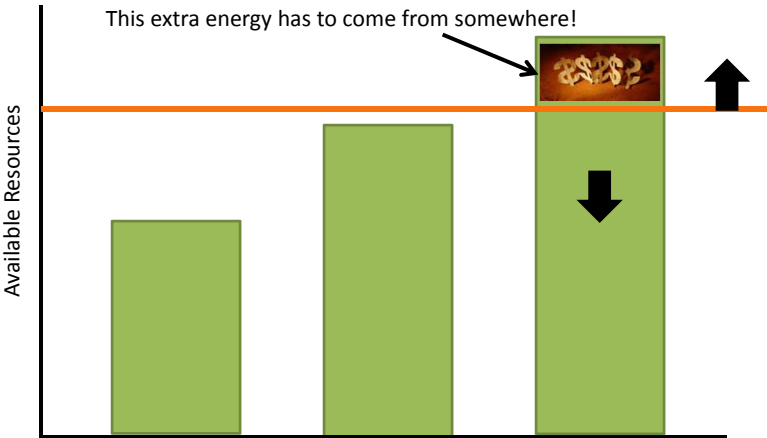


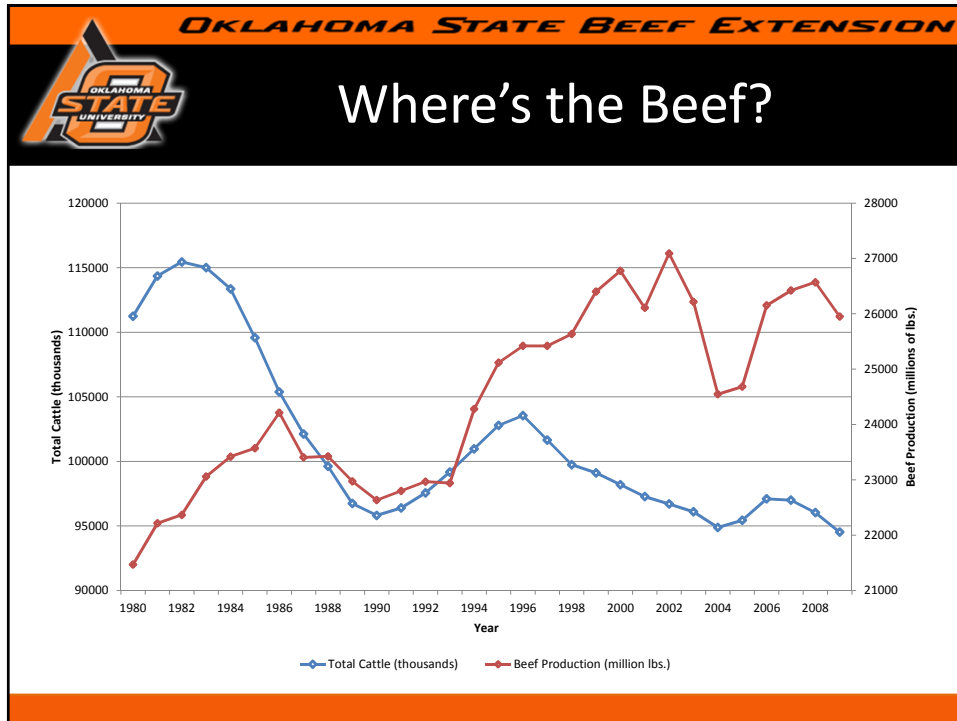
OKLAHOMA STATE BEEF EXTENSION

Considerations

Available Resources

This extra energy has to come from somewhere!





OKLAHOMA STATE BEEF EXTENSION




Increased Size!

- Lower Inventory
- Increased lbs. of beef
 - Some from technology
 - The rest from increased growth
 - Increased carcass weights
 - Increased Cow Mature Size!
 - Good for the packers-is it good for the cowman?
 - More size, more growth, more feed, more money
 - Can we figure out how to do more with less?



OKLAHOMA STATE BEEF EXTENSION




Optimal Characteristics

Table 4. Matching genetic potential for different traits to production environments.¹


Production Environment			Traits
Feed Availability	Stress ²	Milk Production	Mature Size
High	Low	M to H	M to H
	High	M	L to H
Medium	Low	M to H	M
	High	L to M	M
Low	Low	L to M	L to M
	High	L to M	L to M

Low Hanging Fruit



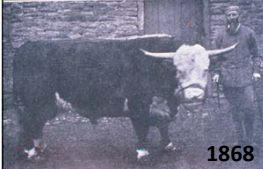
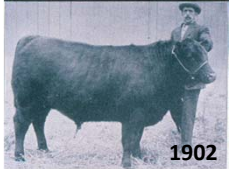




L = Low; M = Medium; H = High.
¹ Adapted from Bullock et al., 2002.
² Heat, cold, parasites, disease, mud, altitude, etc.
³ Ability to store fat and regulate energy requirements with changing (seasonal) availability of feed.
⁴ Physiological tolerance to heat, cold, internal and external parasites, disease, mud, and other factors.

OKLAHOMA STATE BEEF EXTENSION




Why Mature Size?

- Why is mature size low-hanging fruit?
 - Easy to select for size!
 - Highly heritable (0.44-0.69; Arango et al. 2002)

<https://www.msu.edu/~ritchih/historical/cattletype.html>

OKLAHOMA STATE BEEF EXTENSION



Mature Size

- Bigger cows have higher maintenance energy requirements

Intake increases ~1.5 lbs./day for each 100 lbs. increase in BW

Cow's Weight	Percentage of Body Weight	Daily DM Intake (lbs.)
900	2.33%	21.0
1000	2.26%	22.6
1100	2.19%	24.1
1200	2.13%	25.6
1300	2.08%	27.0
1400	2.04%	28.6
1500	2.00%	30.0
1600	1.97%	31.5
1700	1.94%	33.0


Bigger cows eat less as a % of body weight-if calves are a lot bigger, this may be the most efficient system!

Cow's Weight	Annual DM Intake (lbs.)
900	7,654
1000	8,249
1100	8,793
1200	9,329
1300	9,870
1400	10,424
1500	10,950
1600	11,505
1700	12,038

NRC, 2002 Calculated from NRC, 2002

McMurray, 2009

OKLAHOMA STATE BEEF EXTENSION



Mature Size

- Bigger cows have higher maintenance energy requirements
 - Marginal increases in weaning weight

$y = 0.0607x + 459$

+6 lbs. WW/100 lbs. cow weight


Urick et al., 1971 = 0.042

Mourer et al., 2010 = 0.064

Dobbs, 2011 = 0.060

1111 spring-calving records on Brangus cows from '02-'09, crossbred calves, El Reno, OK C.D. Dobbs, M.A. Brown, D.L. Lalman

OKLAHOMA STATE BEEF EXTENSION



Breakevens

- Cost of additional 100 lbs. cow body weight/year is ~\$42
 - Doye and Lalman 2011

*Breakeven Weight per 100 lbs. = (Additional Calf WW * Market Value) – Additional Cow Cost*
*Breakeven weight per 100 lbs. = (X lbs. * 1.45 per lb.*) – \$42*


Breakeven Weight of ~29 lbs. WW per 100 lbs. additional body weight!

*Breakeven \$ per 100 lbs. = (Additional Calf WW * Market Value) – Additional Cow Cost*
*Breakeven \$ per 100 lbs. = (6 lbs. * X per lb.*) – \$42*

Breakeven of ~\$7/lb. of additional WW per 100 lbs. additional body weight!

* ~550 lb. steer and heifer average from OKC sale on 8/27/2012

OKLAHOMA STATE BEEF EXTENSION




Mature Size

Smaller cows can be an asset!

Weight Grp.	Num. Records	Avg. Wt.	Wean Wt.	Percent
<1300	37	1242	617	49.7%
1300-1400	39	1357	611	45.0%
1400-1500	38	1456	589	40.5%
1500-1600	33	1549	598	38.6%
>1600	22	1698	572	33.7%

Ringwall, 2008 <http://www.beeftalk.com/images/fullsizecolor/bt408color.jpg>, 5-9 yr old cows at Dickinson Research Extension Center in Dickenson, ND

OKLAHOMA STATE BEEF EXTENSION



Cowboy Math

- 5,000 lbs. DM/acre
 - Use ¼ (1,250 lbs.)
- 1000 lb. cow needs 6.5 acres/yr.
- 1600 lb. cow needs 9 acres/yr.

- 160 acres:
 - 17 cows @ 1600 lb.
 - Baseline 600 lb. calf = 8,400*\$1.40 = \$11,760
 - 24 cows @ 1000 lb.
 - 564 lb. calves = 13,536*\$1.42 = \$19,221


Annual DM intake for cows of varying weights.

Cow's Weight	Annual DM Intake (lbs.)
900	7,654
1000	8,249
1100	8,793
1200	9,329
1300	9,870
1400	10,424
1500	10,950
1600	11,505
1700	12,038

Calculated from NRC, 2002

Income Difference=\$7,461


OKLAHOMA STATE BEEF EXTENSION




Fit the Environment

- Optimize for environment and resources
 - Labor
 - Time
 - Forage
 - Grain
- Methods:
 - Breed Type
 - Decision Support software
 - EPDs
 - Crossbreeding
 - Genomics

OPTIMIZE PRODUCTION TRAITS



OKLAHOMA STATE BEEF EXTENSION



Breed Type

Table 1. Breeds grouped into biological type by four criteria.^{a,b}

Breed Group	Growth Rate and Mature Size	Percent Retail Product	Age at Puberty	Milk Production
Limousin	XXX	XXXX	XXXX	X
Charolais	XXXXX	XXXX	XXXX	X
Simmental	XXXXX	XXXX	XXX	XXXX
Angus	XXX	XX	XX	XXX
Hereford	XXX	XX	XXX	XX
Shorthorn	XXX	XX	XXX	XXX
Brahman	XXX	XXX	XXXXX	XXX
Nellore	XXX	XXX	XXXXX	XXX
Braunvieh	XXXX	XXXX	XX	XXXX
Gelbvieh	XXXX	XXXX	XX	XXXX
Brangus	XXX	XX	XXXX	XX
Santa Gertrudis	XXX	XX	XXXX	XX


Two Easy Ways to Contain Costs and Inputs:

1. Optimize Growth and Mature Size
2. Optimize Milk Production

These are guidelines-Animals can usually be found in any breed that fit these characteristics

^a Adapted from Cundiff et al. 1993.
^b Increasing number of X's indicate relatively higher levels of trait.


OKLAHOMA STATE BEEF EXTENSION



Decision Support Software

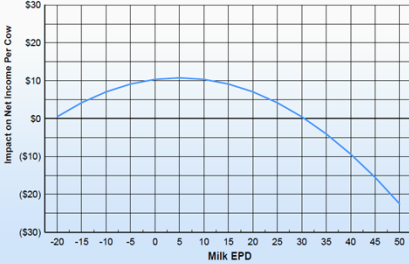
- User-defined inputs are more customized
- Charolais Terminal sire profitability index
 - <http://index.charolaisusa.com/profitindexall.aspx>
- ERT Tool
 - <http://ert.agsci.colostate.edu/>
- Angus Optimal Milk Module
 - <http://www.angus.org/Performance/OptimalMilk/OptimalMilkMain.aspx>

OKLAHOMA STATE BEEF EXTENSION



Optimal Milk Module

Economic Value of Varying Milk EPDs



RESULTS

Current Assumptions for Your Herd			
Average Cow Weight:	1150 lbs	Milking Ability:	Medium-low
Pasture & Feed Cost:	\$285	Feed Variability:	Extremely variable

Estimated Cost of Feed Energy for Your Farm or Ranch: \$0.079 per Mcal.

The Angus Optimal Milk EPD range for your operation is: 8 to 12 lbs

Using Your Results Click Here
Your feed costs are significantly above average.
Your pasture and feed supplies tend to be highly variable from year to year.

To view the Economics of Milk EPDs for your operation: [Click Chart](#)

RESULTS

Current Assumptions for Your Herd			
Average Cow Weight:	1350 lbs	Milking Ability:	Medium-high
Pasture & Feed Cost:	\$205	Feed Variability:	Moderately variable

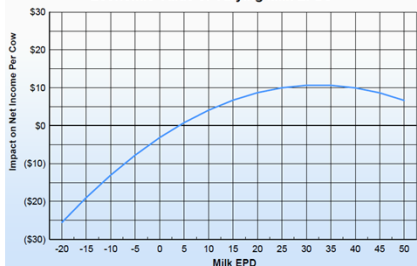
Estimated Cost of Feed Energy for Your Farm or Ranch: \$0.049 per Mcal.

The Angus Optimal Milk EPD range for your operation is: 31 to 35 lbs


Using Your Results Click Here

To view the Economics of Milk EPDs for your operation: [Click Chart](#)

Economic Value of Varying Milk EPDs



OKLAHOMA STATE BEEF EXTENSION



EPDs

- Expected Progeny Differences
- “Correct” for environmental differences and genetic merit of the dam
- 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
- Relative performance, not absolute values

What does it mean? Sire A EPD=30 NOTHING!	What does it mean? Sire A WW EPD=30 Sire B WW EPD=40 We expect calves out of sire B to average ~10 lbs. heavier at weaning than the average of calves out of sire A (bred to same cows)	What does it mean? Sire A WW EPD=30 Breed rank=25% Top 25% of his breed Expect only 1 of 4 bulls to sire calves with heavier weaning weights (bred to same cows)
-----------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

OKLAHOMA STATE BEEF EXTENSION

EPDs for Some Limiting Traits

Breed	Growth				Reproduction				Carcass				Ultrasound		Other												
	Birth Weight	Weaning Weight	Milk	Yearling Weight	Total Maternal	Yearling Height	Mature Height	Mature Weight	Scrotal Circumference	Gestation Length	Calving Ease Direct	Calving Ease Maternal	Heifer Pregnancy	Carcass Weight	Ribeye Area	Fat Thickness	Marbling	Retail Product	Yield Grade	Tenderness	Intramuscular Fat (%)	Ribeye Area	Fat Thickness	Retail Product	Stayability	Maintenance Energy	Docility
Angus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Blonde d'Aquitaine	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Beefmaster	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brahman	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brangus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Braford	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Braunvieh	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Charolais	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Chianina	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gelbvieh	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hereford	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Limousin	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Maine-Anjou	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Red Angus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Red Brangus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Romagnola	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Salers	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Santa Gertrudis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Senepol	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shorthorn	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Simmental	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Tarentaise	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table from NBCEC Sire Selection Manual

OKLAHOMA STATE BEEF EXTENSION


Independent Culling Levels

EPDs aren't just useful to select for more!

Output Traits

Limiting Traits

OKLAHOMA STATE BEEF EXTENSION




AB-EPDs

	Trait	BW	WW	MA	REA	MARB
Angus	EPD	-1.3	54	26	-0.09	0.71
	Conversion	0	0	0	0	0
	AB-EPD	-1.3	54	26	-0.09	0.71
	Prev/New Rank	1/1	1/2	1/1	3/3	1/1
Charolais	Trait	BW	WW	MA	REA	MARB
	EPD	0.5	32	14	0.74	0.15
	Conversion	8.6	40.1	5.7	0.92	-0.46
	AB-EPD	9.1	72.1	19.7	1.66	-.31
Prev/New Rank	2/3	3/1	3/2	2/2	2/2	
Limousin	Trait	BW	WW	MA	REA	MARB
	EPD	1.1	49	22	1.08	0.06
	Conversion	3.8	-0.9	-9.2	1.07	-0.7
	AB-EPD	4.9	48.1	12.8	2.15	-0.64
Prev/New Rank	3/2	2/3	2/3	1/1	3/3	

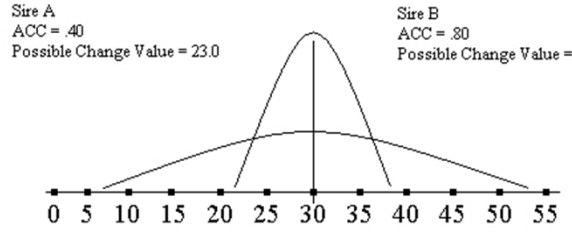
Calculator is posted on the www.beefextension.com website!

OKLAHOMA STATE BEEF EXTENSION



EPD Accuracy

- EPDs are not static-they change over time
 - Accuracy!
- Increases with more data
 - Individual performance or relatives
 - Also with genomic data (marker panels)
- Risk management tool!

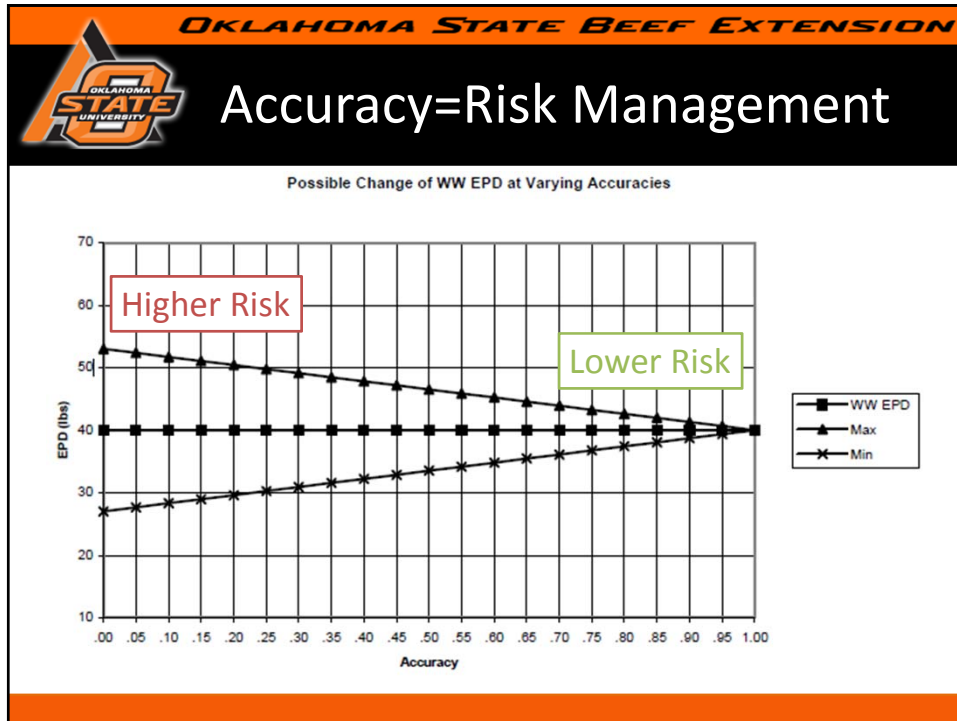


Sire A
ACC = .40
Possible Change Value = 23.0


Sire B
ACC = .80
Possible Change Value = 8.5

0 5 10 15 20 25 30 35 40 45 50 55

Figure from charolaisusa.com




OKLAHOMA STATE BEEF EXTENSION




Effect of Genomic Testing on EPDs

Accuracy




EPD



- Accuracy increases according to:
 - Predictive ability of the test
 - Original accuracy of the animal
- Seedstock: How much value do I gain vs cost of test
- Commercial: What premium can I pay for increased accuracy from genomic testing?

OKLAHOMA STATE BEEF EXTENSION



GE-EPD Accuracy Increase


Table 1: GE-EPDs and approximate progeny equivalents

	AGI heritability	AGI HD 50K correlation	Avg. change in EPD from HD 50K ¹	Avg. 50K change in ACC from 0.05 ²	Approximate progeny equivalents
Birth wt.	0.42	0.51	±.45 lb.	0.25	8
Weaning wt.	0.20	0.52	±2.2 lb.	0.23	16
Residual ADG ³	0.31	0.65	±0.03 lb./day	0.27	13
Yearling wt. ⁴	0.20	0.64	±3.1 lb.	0.27	20
Milking ability	0.14	0.32	±1.2 lb.	0.15	12
Carcass wt.	0.31	0.48	±4.1 lb.	0.17	7
Fat thickness ⁵	0.26	0.56	±0.01 in.	0.23	11
Ribeye area ⁵	0.32	0.60	±0.10 in. ²	0.23	9
Marbling score ⁵	0.26	0.57	±0.08 units	0.24	12

¹Derived from Angus animals with \leq 0.30 accuracy.
²Represents accuracy from only pedigree information.
³Dry-matter intake.
⁴Postweaning ADG.
⁵Carcass progeny records — equivalent to more than 30 scanned progeny records.

Source: Pfizer Animal Genetics.

OKLAHOMA STATE BEEF EXTENSION




Selection Indices

- Easy multiple trait selection
- One of easiest ways to select for PROFIT
- Generally, only use 1 index at a time

1. ID your production and marketing system
 - Market end point (when and how they are marketed)
 - Current performance and genetic level
 - Terminal or keeping replacements?
2. ID index appropriate to the production system
 - What traits are included?
 - Current performance and genetic level

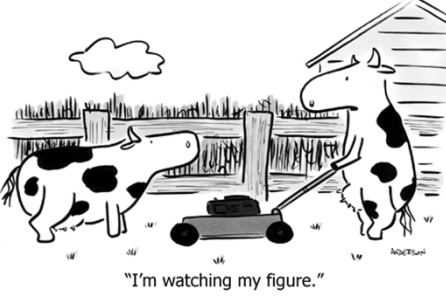
OKLAHOMA STATE BEEF EXTENSION



Use of Selection Indexes


- Select for the highest index values
 - Limit use of additional EPDs
 - Muddy the waters, decrease intensity
 - Set limits on those that are important
 - Mature Size
 - Milk Production
 - Calving Ease
 - Don't duplicate what's already in the index
 - Use one index at a time

© MARK ANDERSON WWW.ANDERSTOONS.COM




"I'm watching my figure."

OKLAHOMA STATE BEEF EXTENSION




Crossbreeding

- Recently under fire
 - Relatively easy way to increase cowherd efficiency
 - Easy management of genetic defects
 - Avoid inbreeding
 - Breed Complementarity
 - Combine "best" traits from each breed
 - Heterosis
 - Crossbred advantage in performance over purebred lines



"And, as you travel life's highway, don't forget to stop and eat the roses."

OKLAHOMA STATE BEEF EXTENSION



Crossbred Advantage

Table 1. Summary of heritability and level of heterosis by trait type.^a


Trait	Heritability	Level of Heterosis
Carcass/end product	High	Low (0 to 5%)
Skeletal measurements		
Mature weight		
Growth rate	Medium	Medium (5 to 10%)
Birth weight		
Weaning weight		
Yearling weight	Low	High (10 to 30%)
Milk production		
Maternal ability		
Reproduction		
Health		
Cow longevity		
Overall cow productivity		

} Breed Complementarity

} Heterosis

^a Adapted from Kress and MacNeil, 1999.

OKLAHOMA STATE BEEF EXTENSION




Crossbred Cow Advantage

- If you only take advantage of heterosis in one place, do it in the cows!

Heterosis largely impacts fertility and longevity—these gains are not at the expense of much larger cows and higher feed costs!

Units and	3.9	
	16.2	
of car	.97	17.0
ulative weaning weight, lb	600	25.3


OKLAHOMA STATE BEEF EXTENSION




Mating Management

- Use crossbred cows to increase fertility and longevity
- Use AI with high accuracy bulls to manage risk
- Use EPDs, indexes, and performance data to optimize cowherd to environment
 - We don't always have to select for more
- Utilize terminal matings to produce calves with high-output genetics while maintaining a moderate cowherd!
 - Address fit to market and consumer preferences

OKLAHOMA STATE BEEF EXTENSION



Questions?



GENETICS

This is how it works

MotivatedPhotos.com

For more information: http://www.nbcec.org/producers/sire_selection/manual.pdf