

Relationship between Marbling and Reproduction



Presented by: Dan Loy

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ANGUS
CONVENTION

The Team



- Katy Lippolis, Assistant Professor and Extension Cow-calf Specialist
- Erika Lundy, Extension Beef Specialist, Southwest Iowa
- Beth Reynolds, Extension Beef Program Specialist
- Patrick Wall, Extension Beef Specialist, Southeast Iowa
- Jamie Williams, Associate Scientist and Project Manager
- Mark Honeyman, Associate Dean, College of Agriculture and Life Sciences

Outline



- Why marbling is important
- Relationship between marbling and maternal traits (previous reviews and studies)
- Components of maternal productivity
- The ISU Beef Breeding Project Case Study
- Summary and conclusions



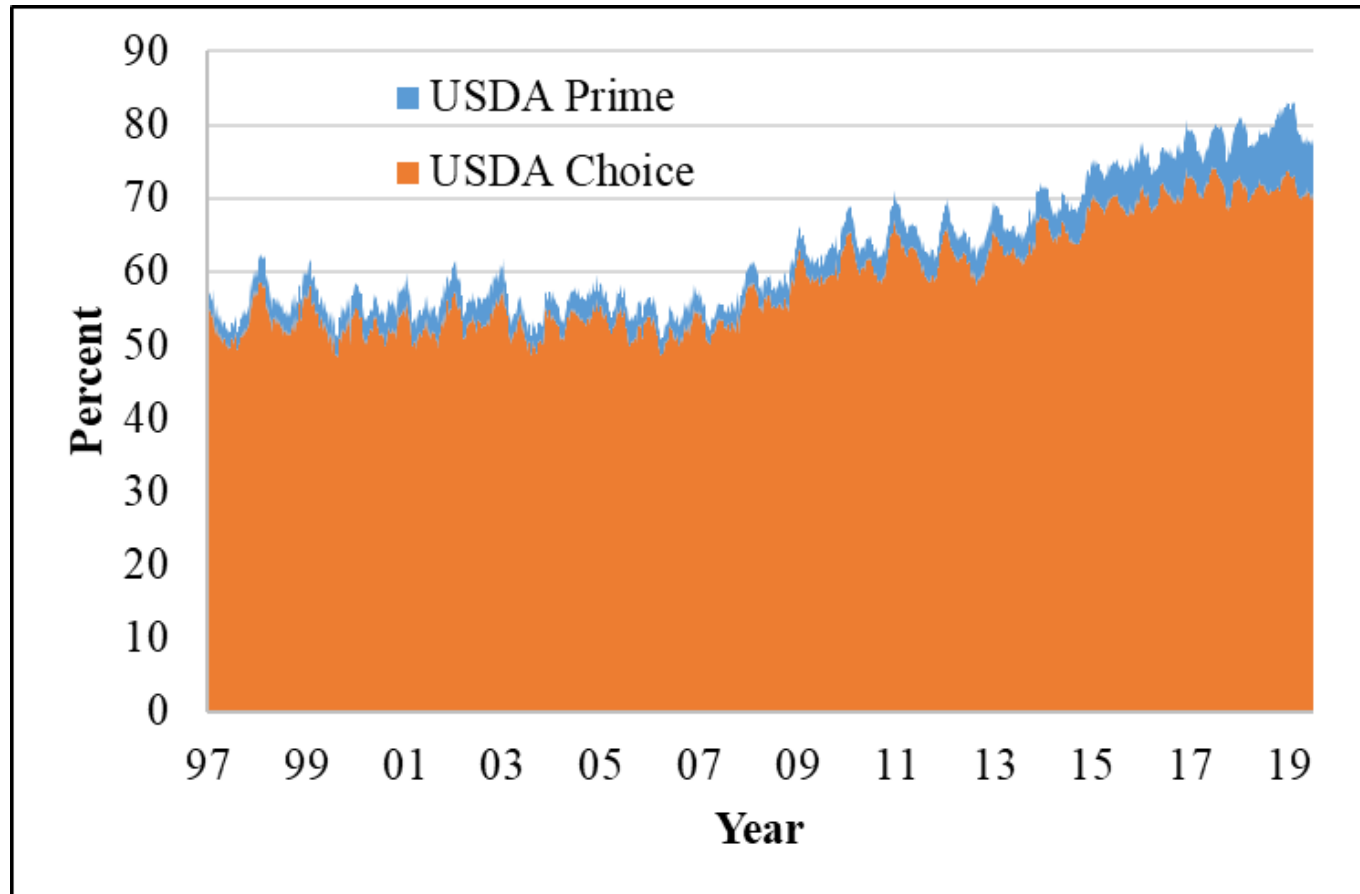
Strip steaks rated acceptable by consumers



USDA Quality Grade	Tenderness	Juiciness	Flavor	Overall liking
Prime	95	92	88	91
Premium Choice	87	85	85	86
Low Choice	86	83	84	83
Select	77	76	75	75
Standard	75	68	72	71

O'Quinn et al. 2018

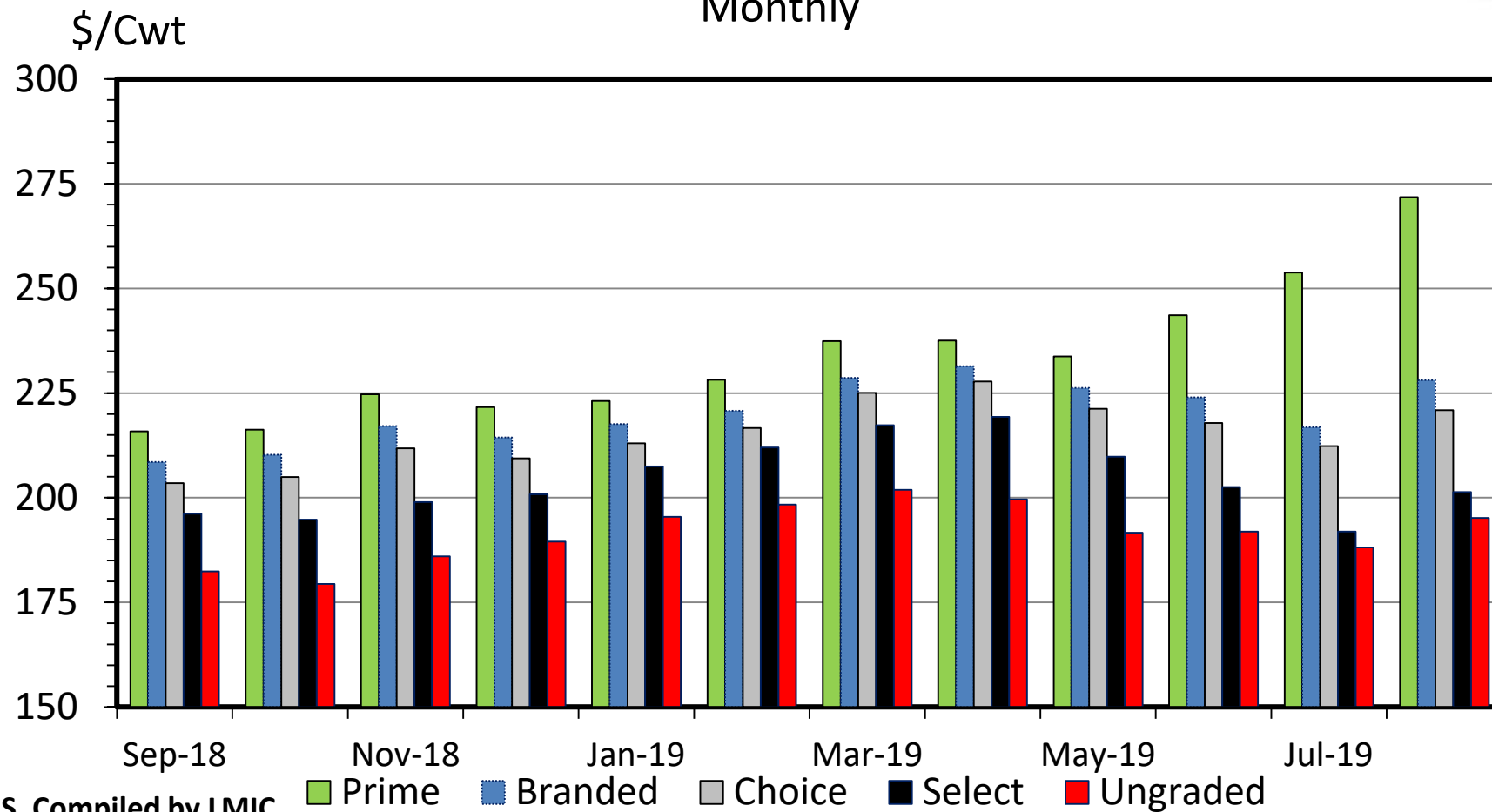
Improvement in US Quality grades from 1997 to present





CUTOUT VALUE

Monthly



Data Source: USDA-AMS, Compiled by LMIC

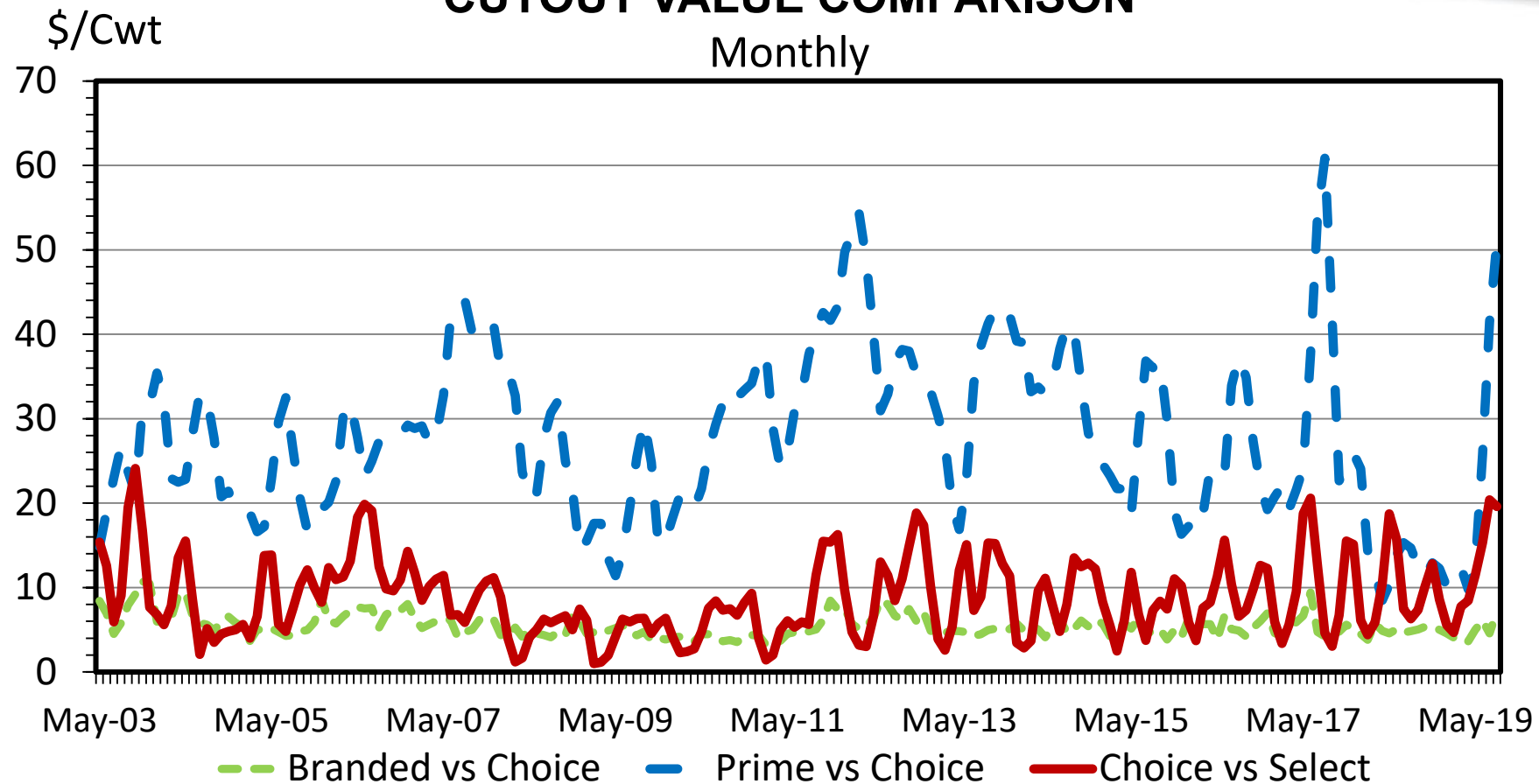
Livestock Marketing Information Center





CUTOUT VALUE COMPARISON

Monthly

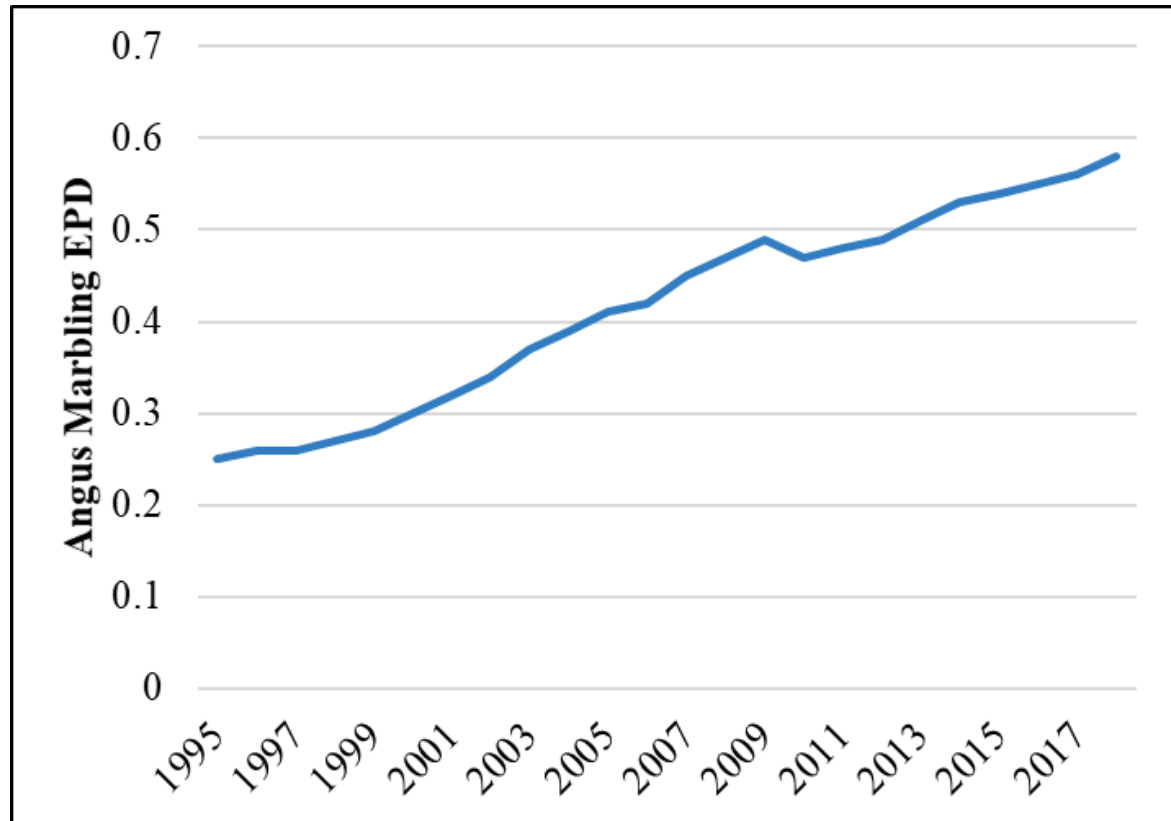


Data Source: USDA-AMS, Compiled by LMIC

Livestock Marketing Information Center



Angus genetic trend for marbling



By birth year, based on EPDs as of September, 2019



Previous Reviews



THE IMPACT OF SELECTING FOR MARBLING ON BEEF COW HERDS
for
Certified Angus Beef
Manhattan, Kansas

by
T. T. Marston
Extension Beef Specialist
Cow-calf Management and Industry
Dept. of Animal Sciences and Industry
Kansas State University
Manhattan, Kansas

J. F. Gleghorn
Extension Assistant

L. E. Wankel
Graduate Student

Selection for Marbling and the Impact on Maternal Traits
Understanding the implications of selection for marbling in a cowherd

J. K. Smith and S. P. Greiner

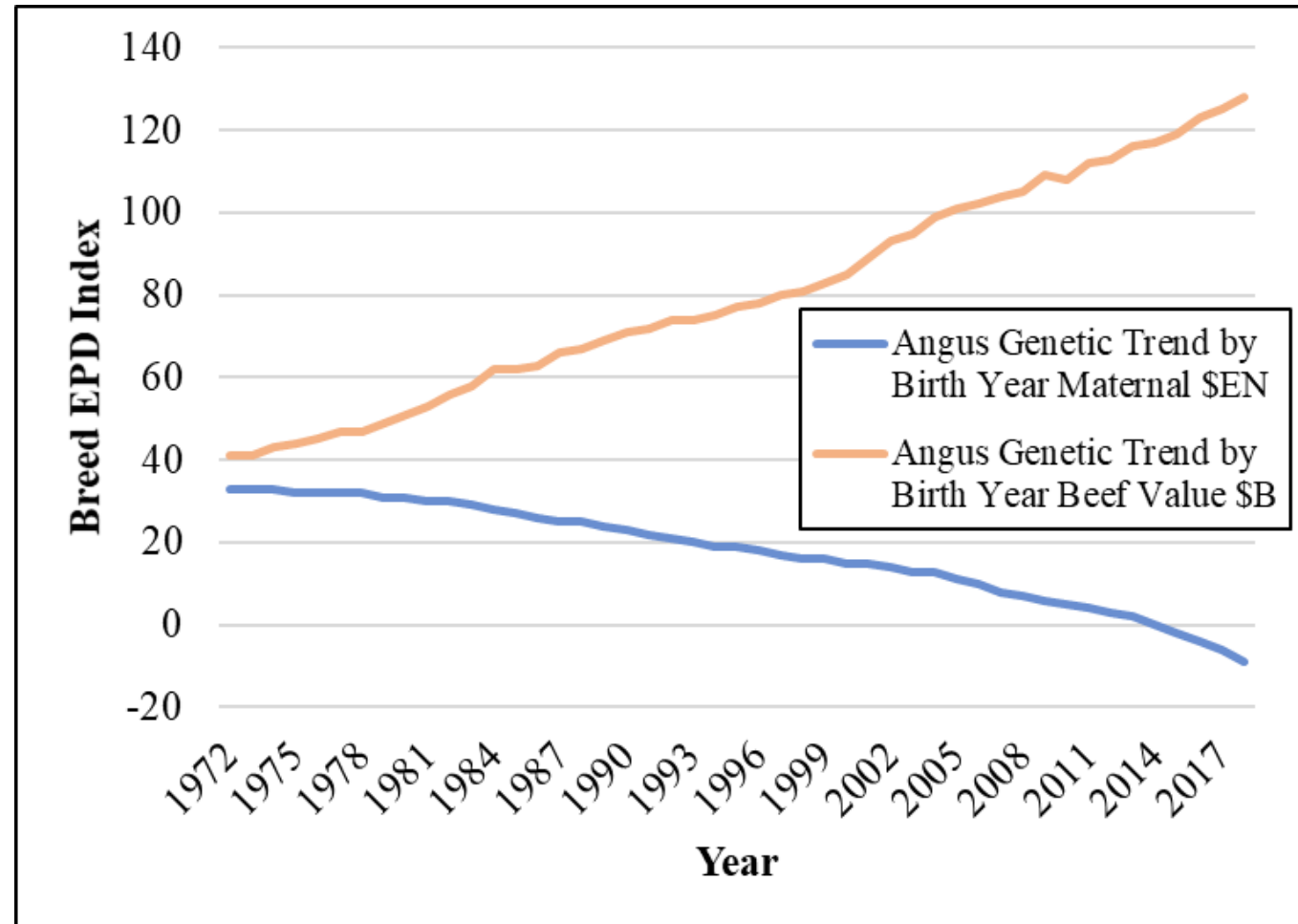
Department of Animal and Poultry Sciences
Virginia Polytechnic Institute and State University
Blacksburg, VA

Completed for Certified Angus Beef LLC
December 2013

<https://www.cabcattle.com/about/research/>



Genetic trends for \$EN and \$B



By birth year, based on EPDs as of September, 2019

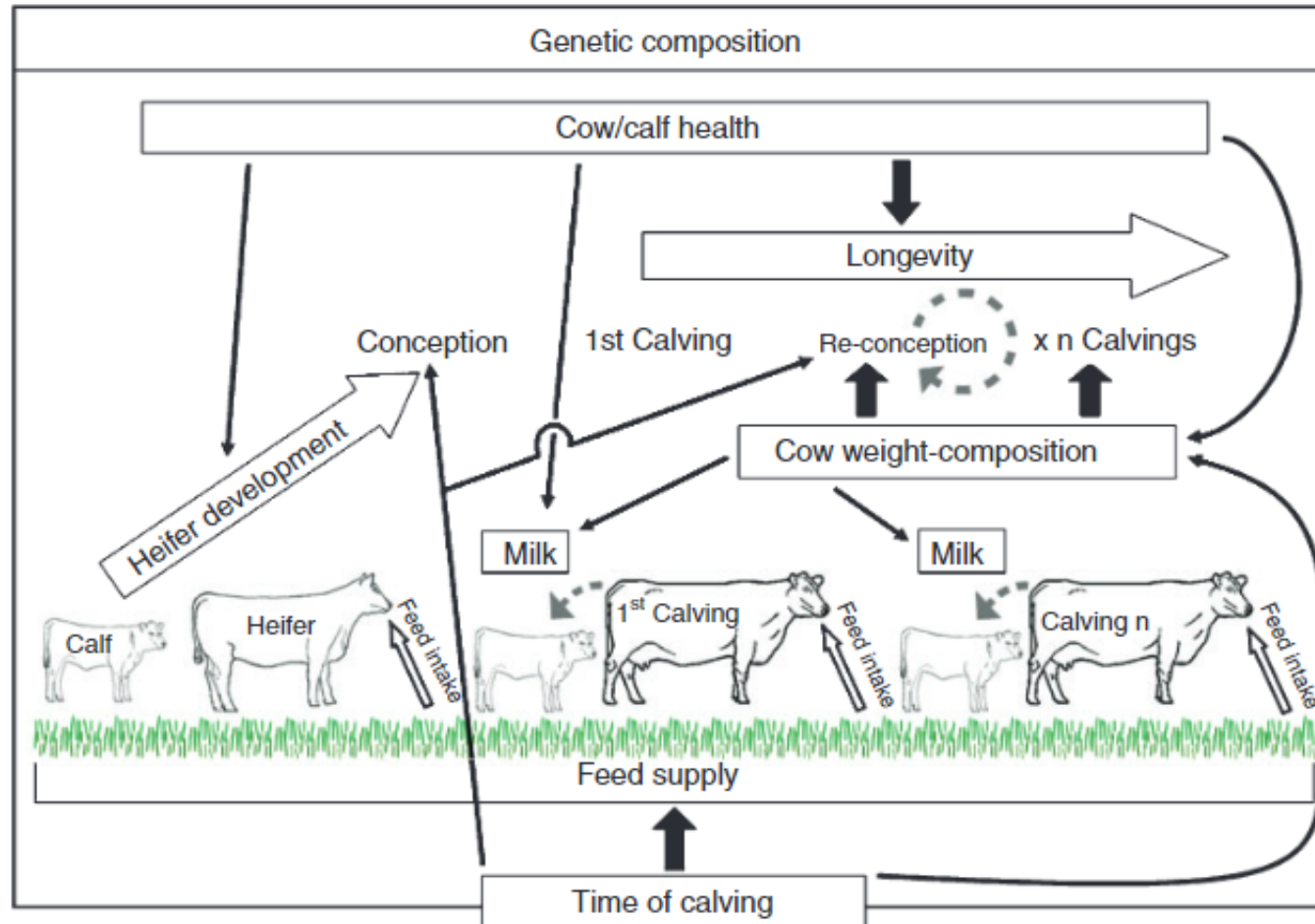
More recent research (Red Angus)



- No genetic relationship between heifer pregnancy and ultrasound intramuscular fat (UIMF)
- Small but positive genetic relationship between stayability and UIMF
- Ultrasound backfat was the best apparent indicator of stayability
- Boldt et al, 2018



Components of maternal productivity



Key components (open boxes or arrows) of maternal productivity and their interactions (closed arrows). Walmsley et. al. (2018)

ISU Angus Breeding Project



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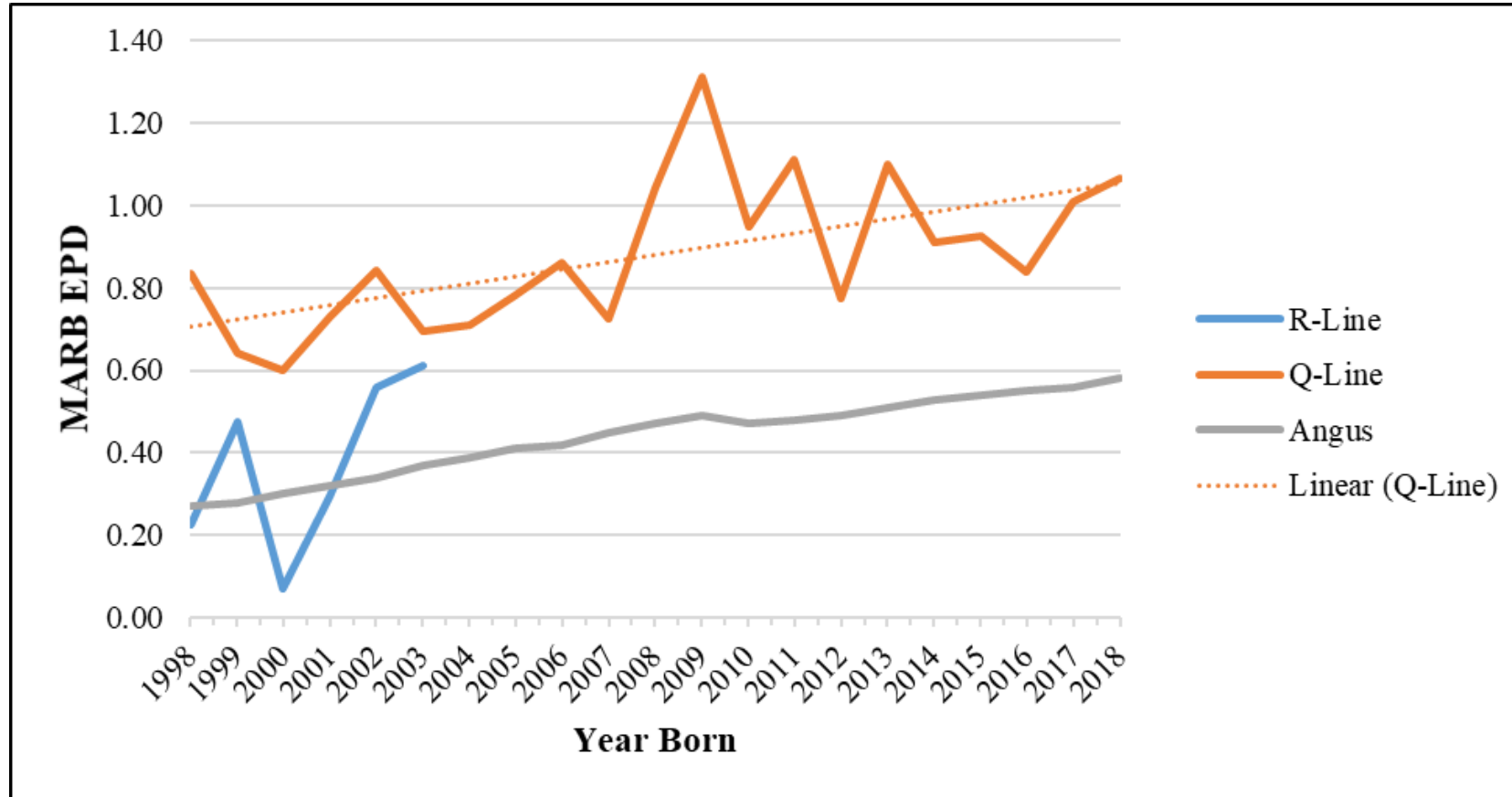
ISU Angus Breeding Project



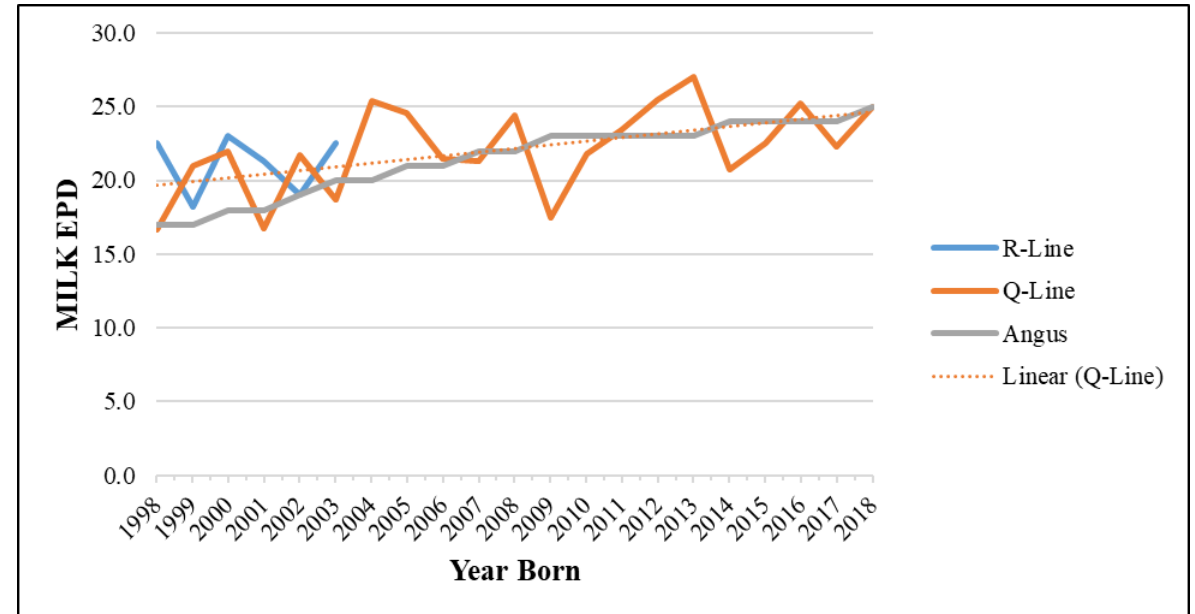
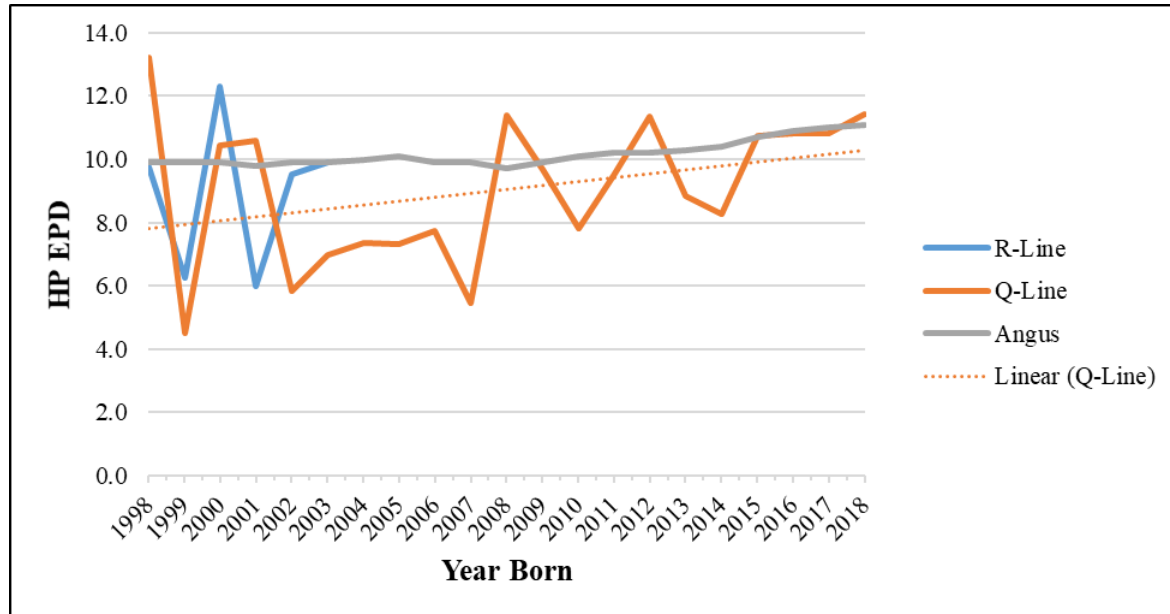
- Began in 1996. Originally with a quality (Q-line) and a retail product (R-line). It has been selected for IMF or marbling for over 20 years.
- Located near Chariton in Southern Iowa
- Approximately 400 cows (300 Spring calving and 100 fall calving)



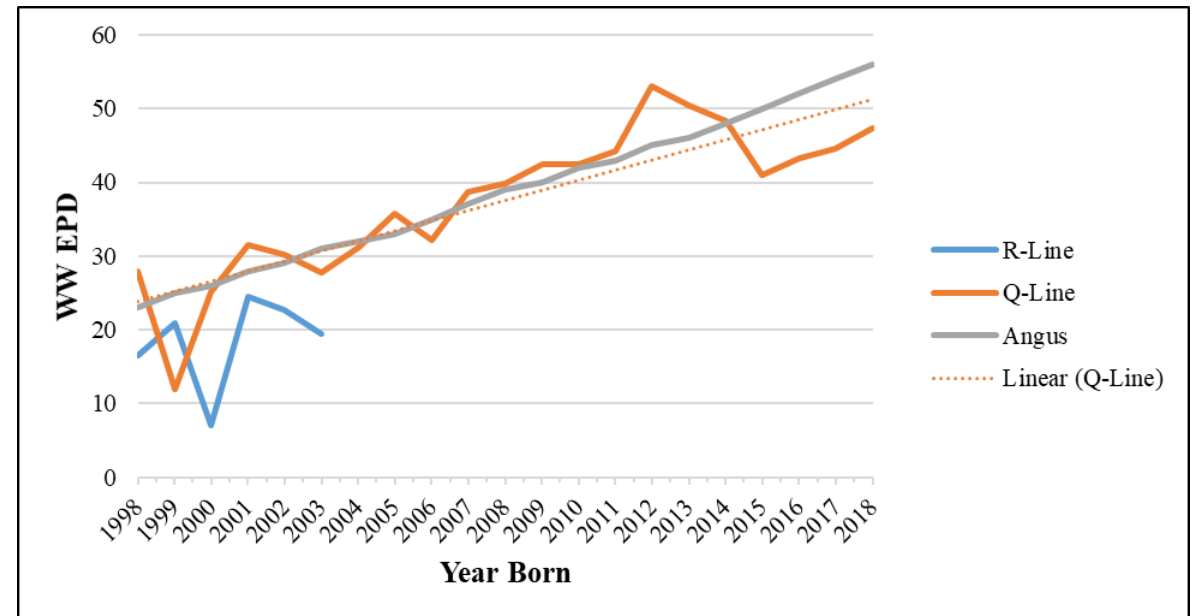
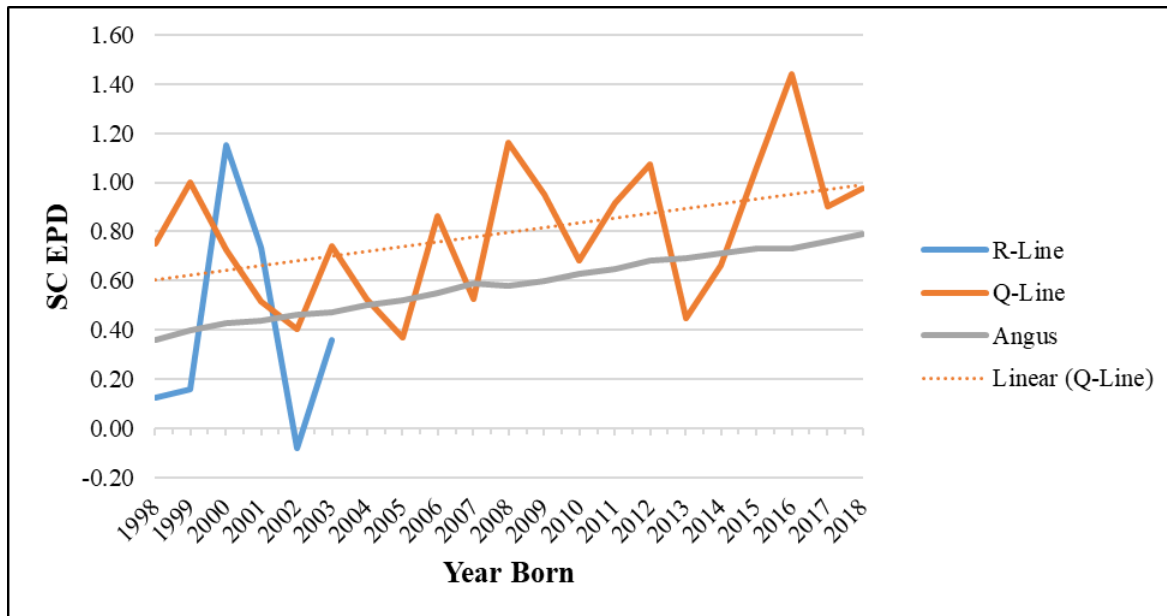
Genetic trends for marbling in ISU herd and Angus breed



Genetic trends for heifer pregnancy and milk for ISU herd and the Angus breed



Genetic trends for scrotal circumference and weaning wt. for ISU herd and the Angus breed



Percent of carcasses by grade and birth year



Year	Total harvested	Choice and higher %	Premium Choice & higher, %	Prime,%	Select and Standard, %
2014	146	97.3	73.3	26.0	2.7
2015	169	98.2	87.6	44.4	1.8
2016	204	92.6	84.3	45.1	7.4
2017	238	98.3	91.6	56.3	1.7
2018*	100	99.0	93.0	57.0	1.0

* Includes only steers born in the Spring of 2018

ISU Breeding project carcass data by birth year



Year	MS ¹	REA, sq. in	FT, in	HCW, lb	YG
2014	1179.6	12.3	0.50	700.0	2.8
2015	1261.6	12.3	0.50	744.0	3.2
2016	1273.5	12.1	0.50	736.5	3.3
2017	1291.9	11.8	0.60	752.1	3.5
2018	1291.7	12.9	0.60	792.5	3.3

Prime cow



Four data sets



- ***ISU Breeding Project EPDs*** for all animals born from 2001 to 2018
- ***Maternal Evaluation*** of calving interval and reproductive success of cows born 2001 to 2016
- ***Ultrasound data*** on all yearling cattle from 2001 to 2011
- ***Yearling bull fertility*** data on two calf crops where BSE and carcass data was collected

ISU Breeding Project EPD summary statistics

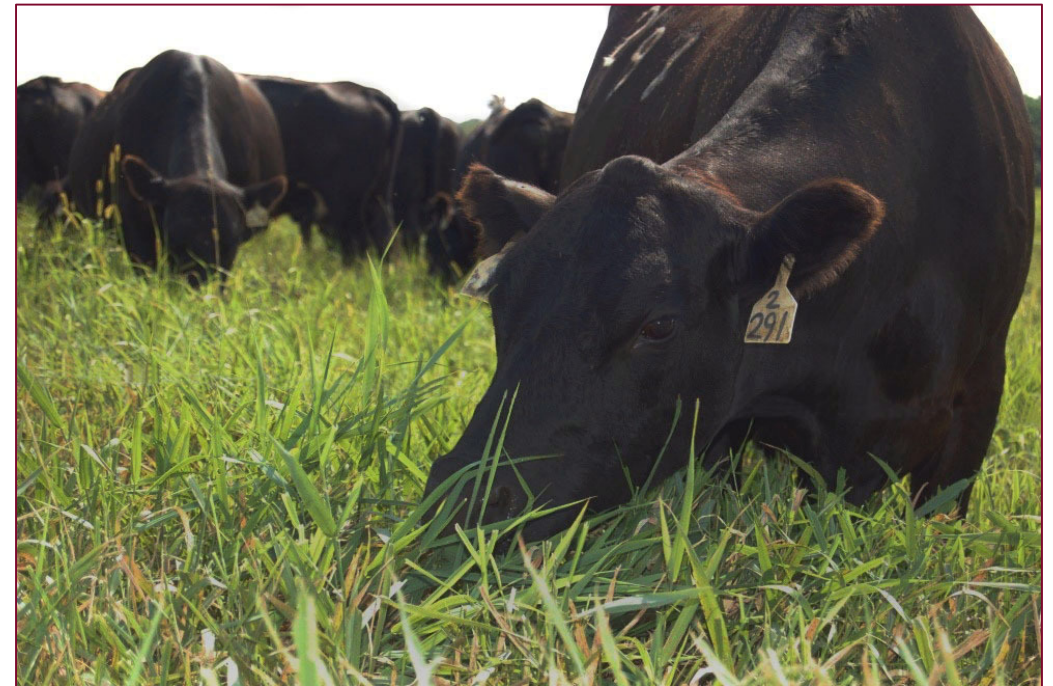


	n	Ave	Std Dev	Min	Max
CED	1,728	4	5.4	-15	18
BW	1,728	1.5	1.90	-4.8	8.8
WW	1,728	33	10.8	-13	66
YW	1,443	58	18.8	-29	122
SC	1,306	0.55	0.47	-0.80	2.82
HP	1,397	9.2	2.84	-0.1	19.3
CEM	1,443	7	4.2	-8	17
MILK	1,443	21	5.2	1	35
CW	1,422	15	14.5	-43	58
MARB	1,422	0.65	0.32	-0.24	1.83
RE	1,422	0.27	0.21	-0.76	0.97
FAT	1,422	0.009	0.023	-0.066	0.084

Herd management



- Heifers are retained from the Spring herd
- Heifers and cows that fail to breed back once fall to the Fall herd
- Cows that fail to breed back in the fall herd are culled



ISU Breeding Project dam EPDs and reproductive performance summary statistics



Variable	n	Ave	Std Dev	Min	Max
NCALF	1,032	4	3.0	1	14
NSCALF	1,032	3	2.6	0	14
CI	827	392	39.7	305	570
CED	855	4	5.4	-13	18
BW	855	1.5	1.91	-4.8	7.5
WW	855	32	10.3	-13	62
SC	787	0.57	0.48	-0.80	2.11
DOC	830	-7	8.8	-32	22
HP	847	9.6	2.61	2.4	17.4
CEM	855	7	4.3	-8	16
MILK	855	21	5.4	2	35
MARB	850	0.67	0.32	-0.24	1.61
RE	850	0.28	0.21	-0.69	0.88
FAT	850	0.009	0.023	-0.063	0.084

Correlation of dam EPDs and reproductive performance



	CED	BW	WW	SC	Doc	MB	RE	FAT
NCALF	-0.035	-0.0113	-0.173**	-0.070	0.014	-0.070**	-0.092**	0.001
NSCALF	0.031	-0.067*	-0.059*	0.014	-0.009	0.059*	-0.026	0.044
CI	-0.077**	-0.027	-0.027	-0.097**	-0.027	-0.024	-0.087**	-0.022

Weak but statistically significant correlations between marbling EPD of dams and number of spring calves (.059, P<.1), total number of calves (.07, P<.05) and calving interval (-.087, P<.05)

ISU Breeding Project progeny ultrasound and dam EPD summary statistics



	n	Ave	Std Dev	Min	Max
UAIMF	1,341	4.81	1.21	1.60	10.39
UARE	1,342	10.53	2.28	4.30	16.30
UARF	1,342	0.26	0.11	0.04	0.68
UARUF	1,340	0.27	0.01	0.04	0.65
CED	1,379	3	5.7	-13	18
CEM	1,379	7	5.0	-8	16
HP	1,379	8.68	2.98	0.00	17.40
MILK	1,379	19.64	6.22	0.00	35.00
SC	1,379	0.42	0.47	-0.80	1.93
MARB	1,379	0.54	0.31	-0.24	1.49
RE	1,379	0.23	0.22	-0.76	0.88
FAT	1,379	0.005	0.025	-0.066	0.081

Correlation of carcass ultrasound and dam EPDs



	UARE	UARF	UARUF	CED	CEM	HP	MILK	SC	MARF	MMF	FAT
UAIMF	0.110**	0.376**	0.323**	0.033	-0.001	-0.003	-0.006	0.007	0.001	0.001	0.113**
UAREA		0.670**	0.611**	0.026	0.021	0.001	0.001	0.031	0.020	0.222**	-0.055**
UARF				0.026	0.038	-0.054**	0.071**	0.047*	0.066**	0.002	0.170**
UARUF				0.043	0.018	-0.031	0.073**	0.080**	0.058**	0.036	0.158**

Weak to no relationship between reproductive or fertility EPDs and ultrasound phenotypes.

ISU Breeding Project yearling bull summary statistics



	n	Average	Std Dev	Minimum	Maximum
Scrotal circumference, cm	120	36.4	2.79	31.0	47.0
Motility, %	114	69.2	19.51	10.0	90.0
Normal morphology, %	114	58.0	23.43	8.0	92.0
Head defects, %	114	2.1	1.95	0.0	11.0
Yearling body weight, lb	120	1127	79.8	900	1340
Average daily gain	110	4.38	1.202	1.71	7.20
Hot carcass weight, lb	112	799.2	66.2	627.0	940.0
12 th rib back fat thickness, in	112	0.50	0.156	0.20	0.91
Ribeye area, sq. in.	112	13.73	1.392	11.10	18.00
Yield grade	112	2.9	0.57	1.41	4.17
Marbling score ¹	112	1074	99.4	900	1409

¹900 = Select; 1000 = low Choice; 1100 = average Choice; 1200 = high Choice; 1300 = Prime

Correlation of ISU Breeding Project yearling bull fertility and actual growth and carcass traits



	MOT	MOR	HD	YBW	ADG	HCW	EPD	MS
SC	-0.161*	-0.175*	-0.223*	0.369**	-0.157*		0.145	0.167*
MOT		0.494**	-0.118	-0.050			-0.039	-0.135
MOR			-0.238**				-0.265**	-0.205**
HD						-0.033	-0.101	-0.024
YBW					-0.160*	0.717**	0.165*	0.164*
ADG							0.261**	0.095
HCW						-0.014	-0.334**	-0.082
BF							0.401**	0.551**
REA							0.170*	0.766**
YG								-0.414**
								0.532**
								0.152
								0.406**

Positive relationships existed between marbling EPD and scrotal size without affecting semen quality.

ISU Breeding Project dam EPDs of yearling bulls used in the analysis



	n	Ave	Std Dev	Min	Max
CED	111	4.8	5.09	-9.0	13.0
BW	111	1.32	1.870	-2.00	7.20
WW	111	35.0	8.80	8.0	54.0
YW	111	64.2	15.37	13.0	95.0
SCE	111	0.68	0.492	-0.52	1.89
HP	111	9.89	2.672	3.90	16.10
CEM	111	7.4	3.77	-3.0	16.0
MILK	111	22.4	5.07	12.0	34.0
MW	111	8.8	23.83	-71.0	58.0
CW	111	18.0	13.12	-15.0	49.0
MARB	111	0.77	0.292	0.00	1.56
RE	111	0.29	0.200	-0.36	0.71
FAT	111	0.01	0.020	-0.03	0.08

Correlation of ISU Breeding Project yearling bull fertility to dam EPDs



No statistical relationships with bull fertility and dam marbling EPD

	CED	BW	WW	YW	SCE	HP	CEM	MILK	MARB	RE	FAT		
SC	-0.036	0.033	-0.078	-0.138	0.136	-0.024	-0.019	-0.151**	-0.139	-0.124	-0.160**	-0.088	
MOT	-0.062	0.117	0.147	0.128	0.033	-0.033	-0.019	0.064	0.031	0.145	0.155	0.133	0.019
MOR	-0.171**	0.172	0.072	0.072	0.033	-0.033	-0.026	-0.149	0.073	0.099	-0.096	0.174**	-0.055
HD	0.191*	0.109	0.131	0.070	0.158**	0.057	0.142	0.013	-0.072	0.065	0.128	0.093	0.054

Conclusions



- Small, positive relationship between milk and marbling EPDs in the herd



Conclusions



- A significant positive relationship ($r = 0.206$) between marbling and heifer pregnancy EPDs in the herd.



Conclusions



- Positive correlations between marbling EPD and the EPDs for scrotal circumference, heifer pregnancy and maternal calving ease.



Conclusions



- Marbling EPD of the cows in the herd had--
 - a weak negative relationship to total number of calves
 - a weak positive relationship to number of calves born in the spring herd (*under the management scheme of the herd*)
 - a weak negative relationship with calving interval.



Conclusions



- Relationships between ultrasound intramuscular fat phenotypes of the progeny were not significantly related to reproductive EPD (CED, CEM, HP, SC and MILK).



Conclusions



- A tendency for a positive correlation between yearling bull scrotal circumference and marbling scores
- No measurable impact on sperm MOT or MOR.



Acknowledgements



- Certified Angus Beef for funding this effort
- Kelli Retallick of AGI for data queries
- Brad Evans and Logan Wallace, current ISU McNay Research Farm Managers
- All prior research farm managers and staff from the ISU Rhodes and McNay Farms
- Doyle Wilson, Gene Rouse, Richard Wilham, Jim Reecy, JR Tait and numerous staff and graduate students that have worked with this herd and project since 1996.

Thank You!

Questions?

www.iowabeefcenter.org

The Zoetis logo is displayed in a stylized, lowercase orange font. It is positioned on the left side of the slide, above a decorative blue mountain range graphic that spans the bottom of the page.

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The Angus Convention logo is located in the bottom right corner. It features the word "ANGUS" in a large, bold, white sans-serif font, with the word "CONVENTION" in a smaller, white sans-serif font directly below it. The text is set against a black rectangular background with a slight shadow effect.

ANGUS
CONVENTION