FEEDING QUALITY

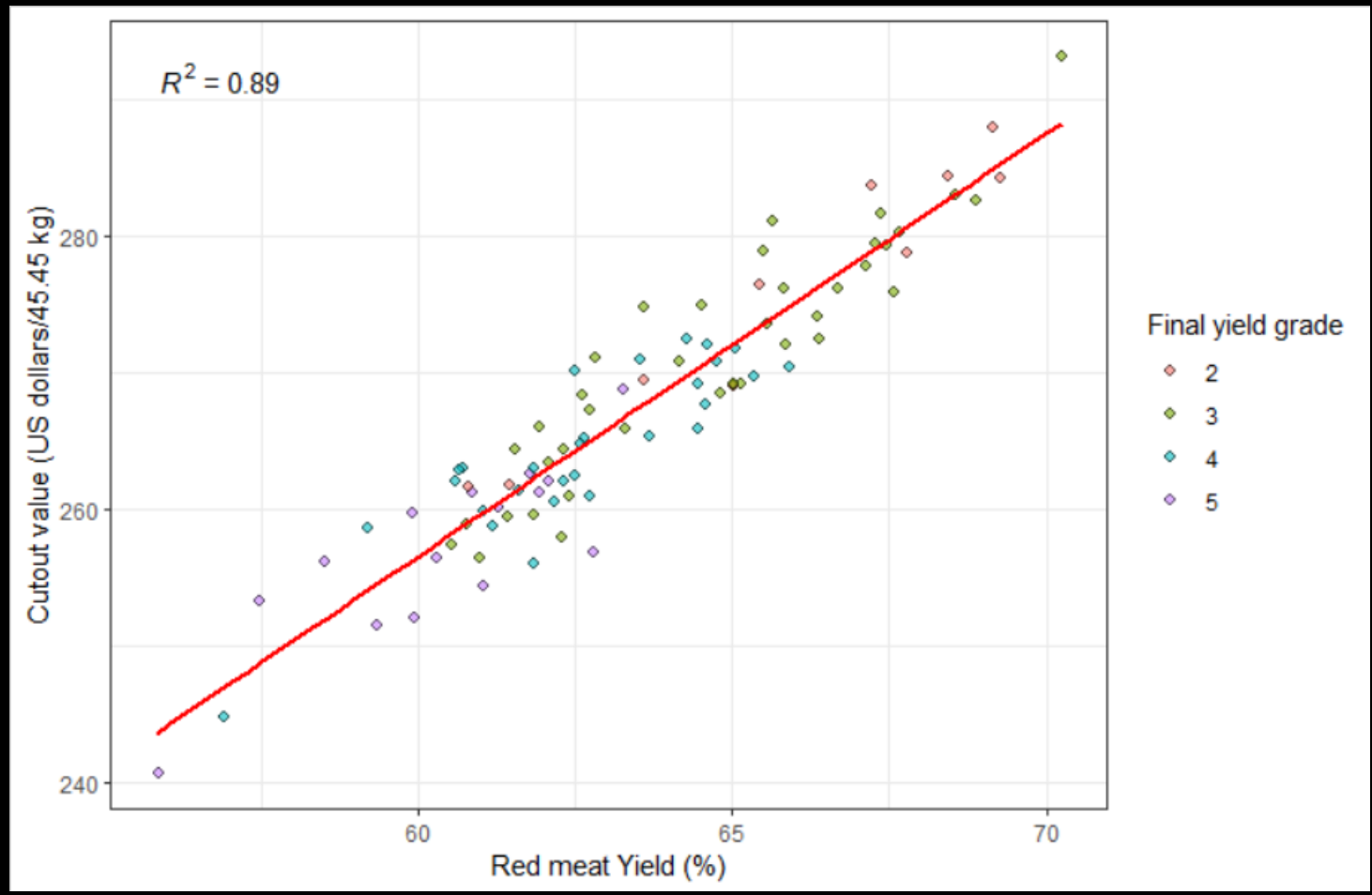
FORUM

Sustainable Gains: Optimizing Meat Production with Marbling Genetics

Drs. Dale Woerner & Daniel Clark

Red Meat Yield = Cutout Value

Cutout value = 71.00 + 3.1(RMY), (*P* = <0.01)



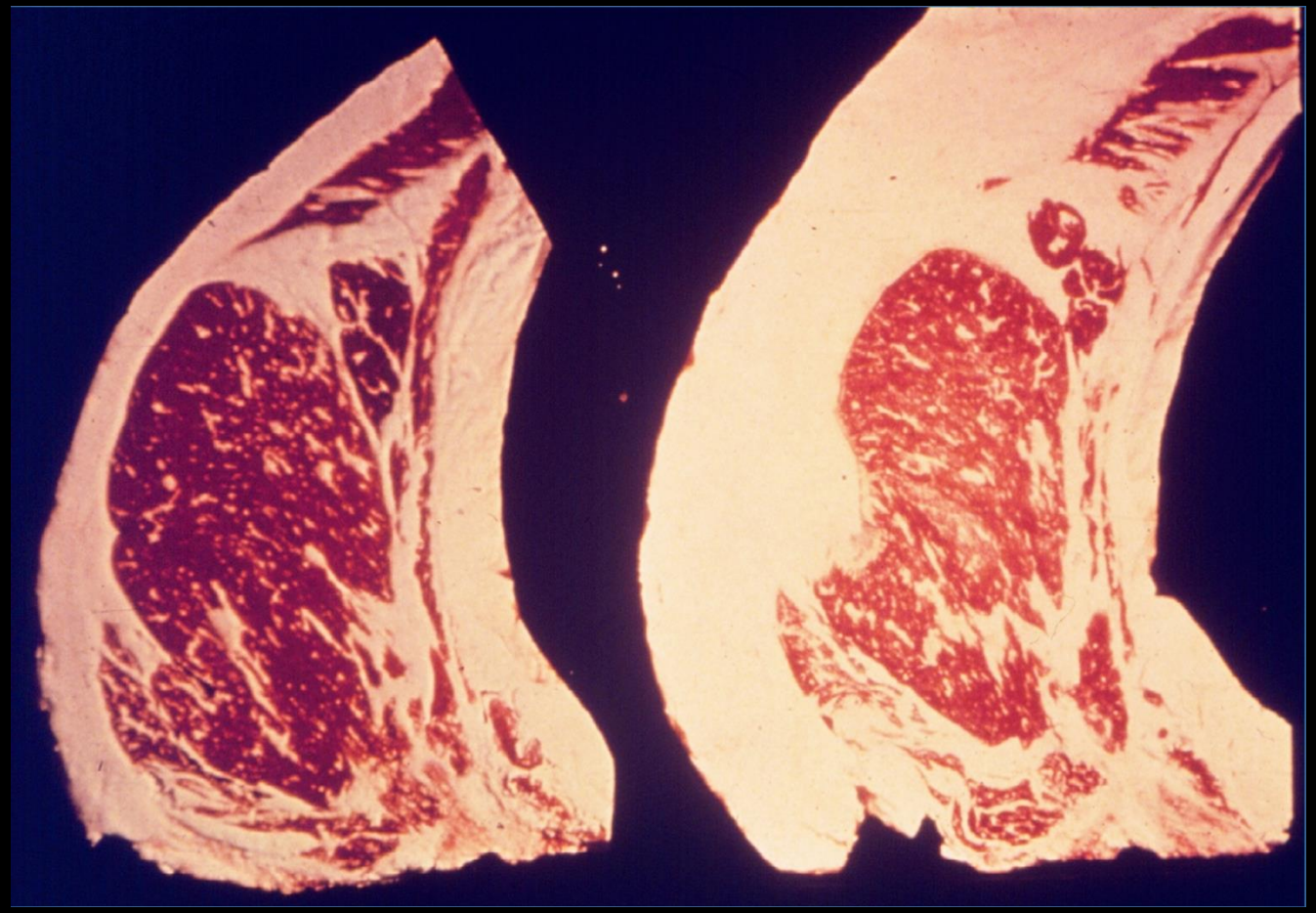
SINCE 1978
CERTIFIED ANGUS BEEF® BRAND
FEEDING QUALITY FORUM

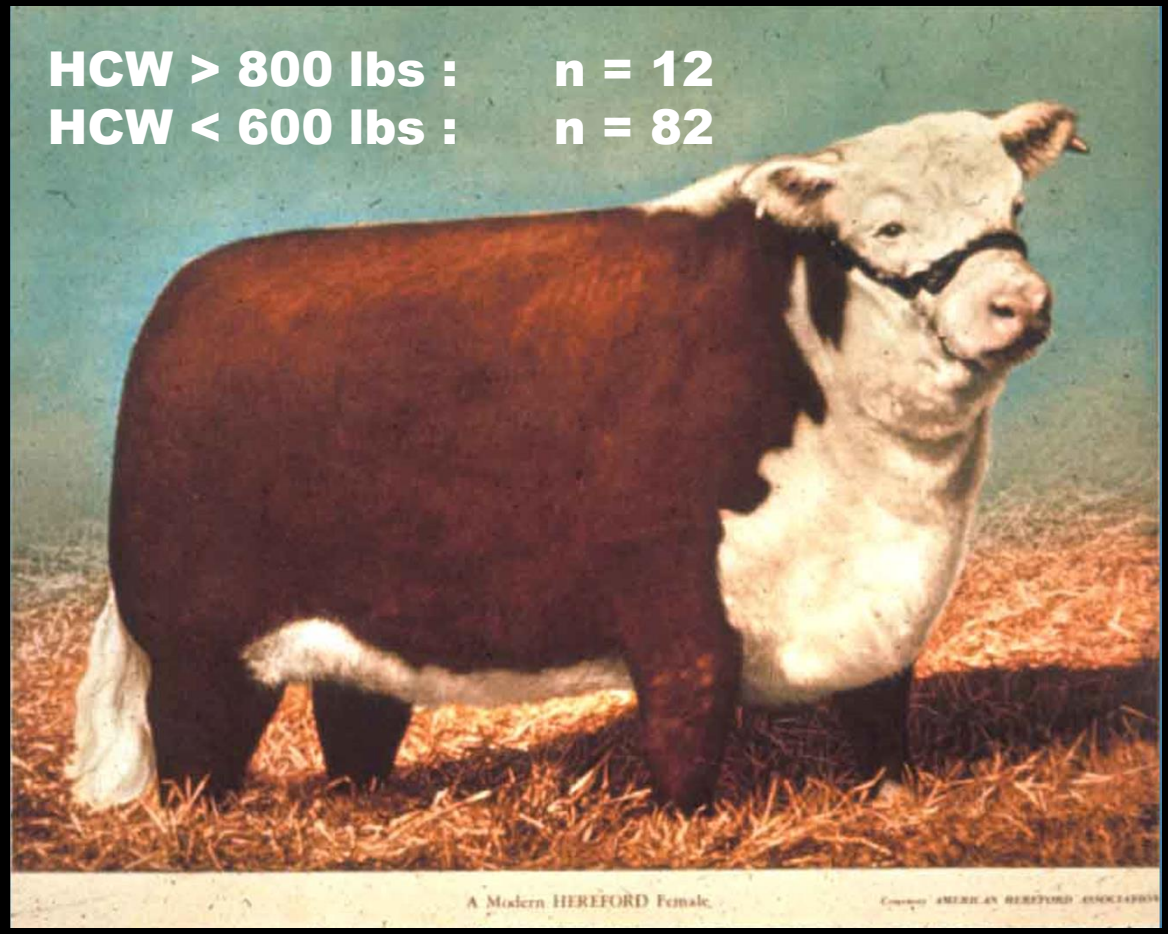
Murphey, 1960 (N = 162)

FEEDING QUALITY FORUM

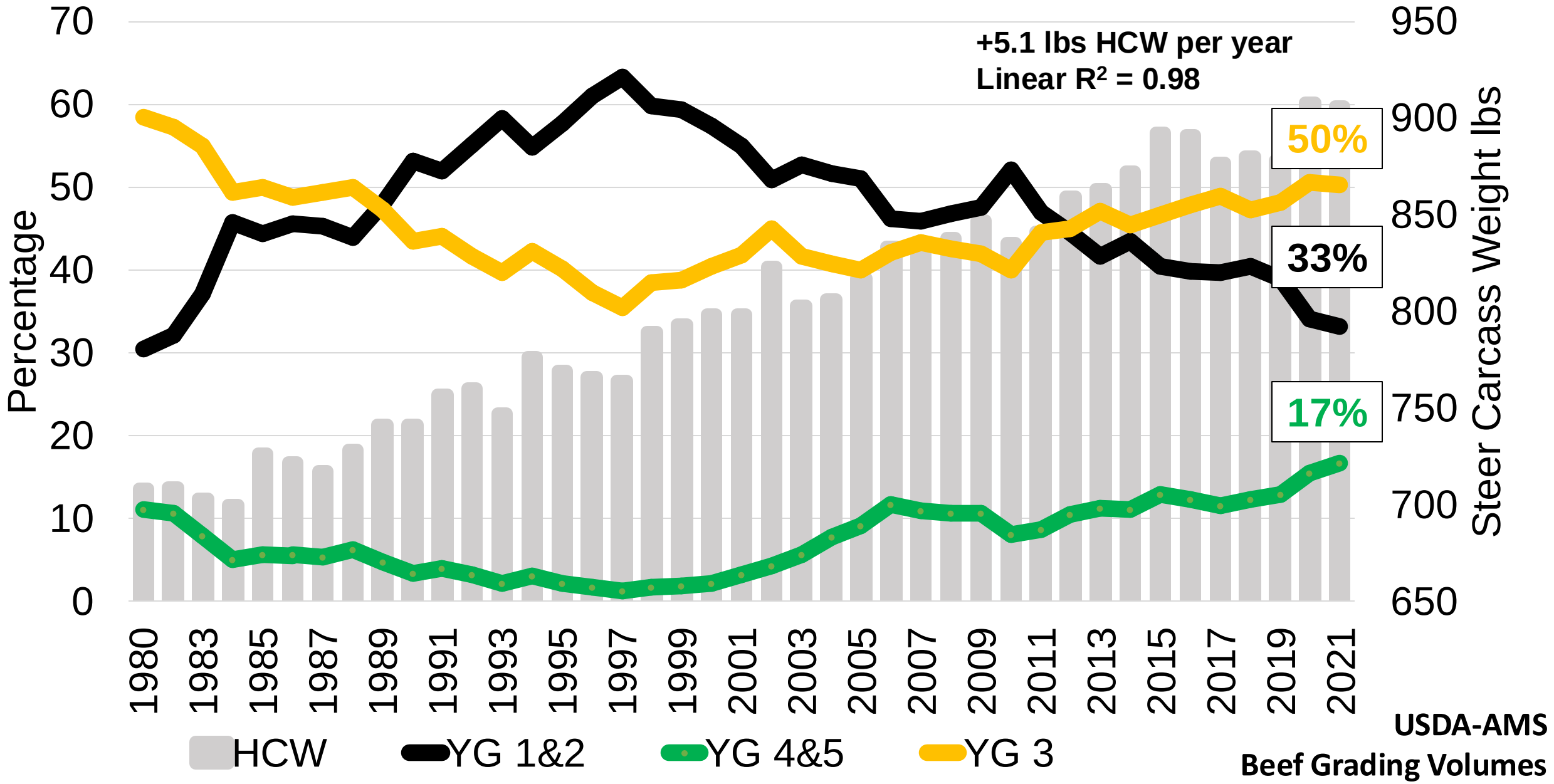
BCTRC (R-L-R-C) = 51.34 – (5.78*FT) – (.462*%KPH) – (.0093*HCW) + (.74*REA)

One unit YG (e.g., 2.0 to 3.0) = 2.3% BCTRC





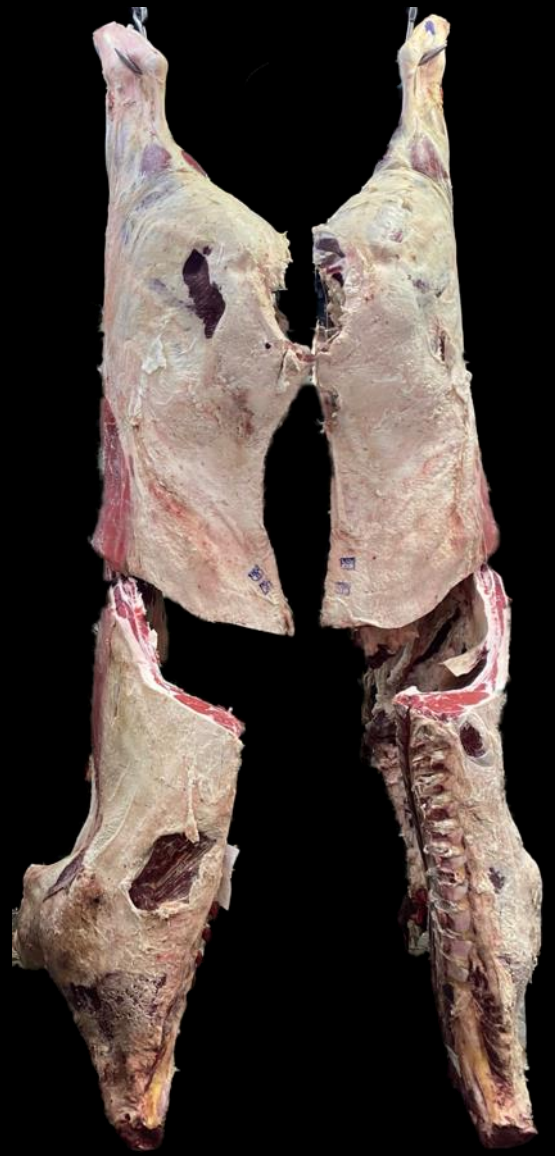
Yield Grade Distributions and Hot Carcass Weight



USDA-AMS
Beef Grading Volumes

Expression of Phenotype & Red Meat Yield

FEEDING QUALITY FORUM

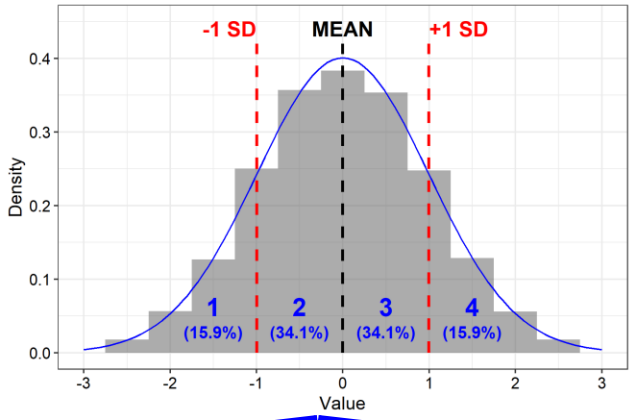


Phenotype's Relationship to Red Meat Yield

6 pens of steers
3 pens of heifers

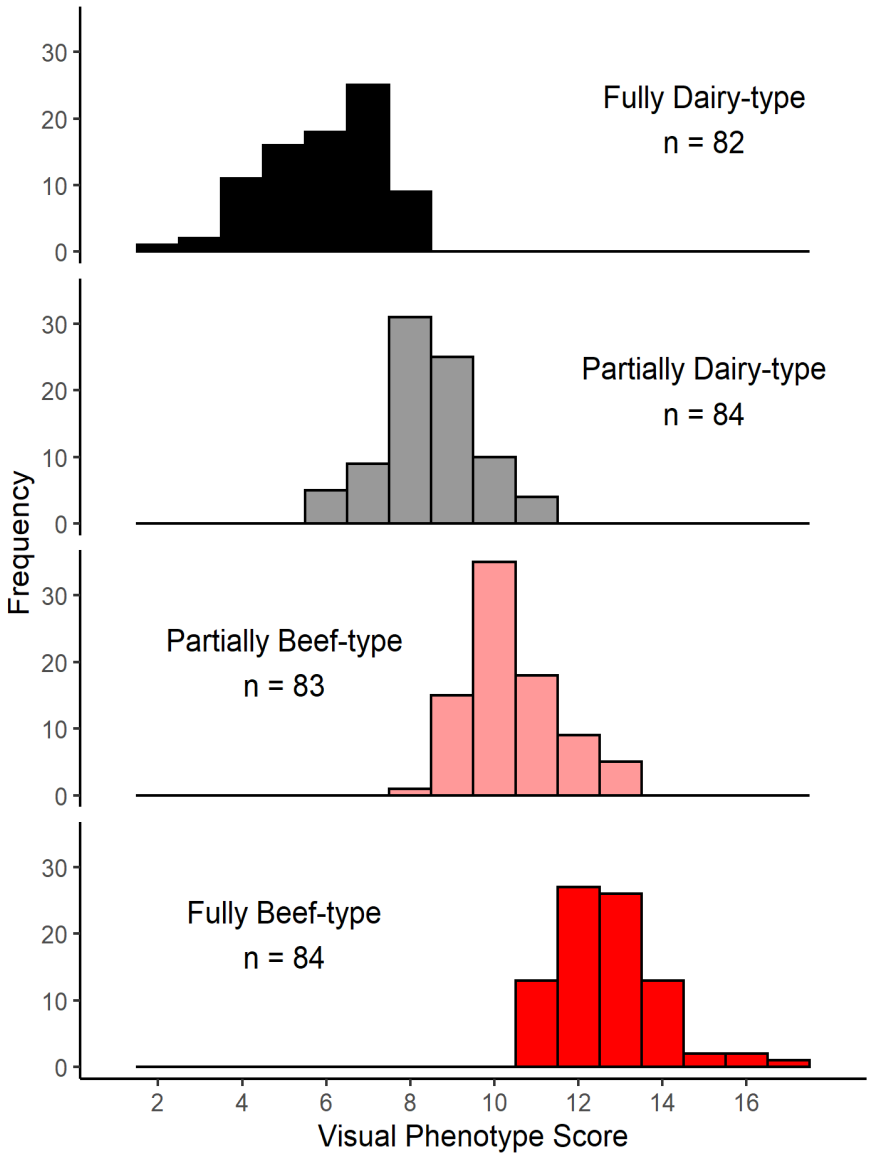
Sire: Angus or SimAngus
Dam: Holstein

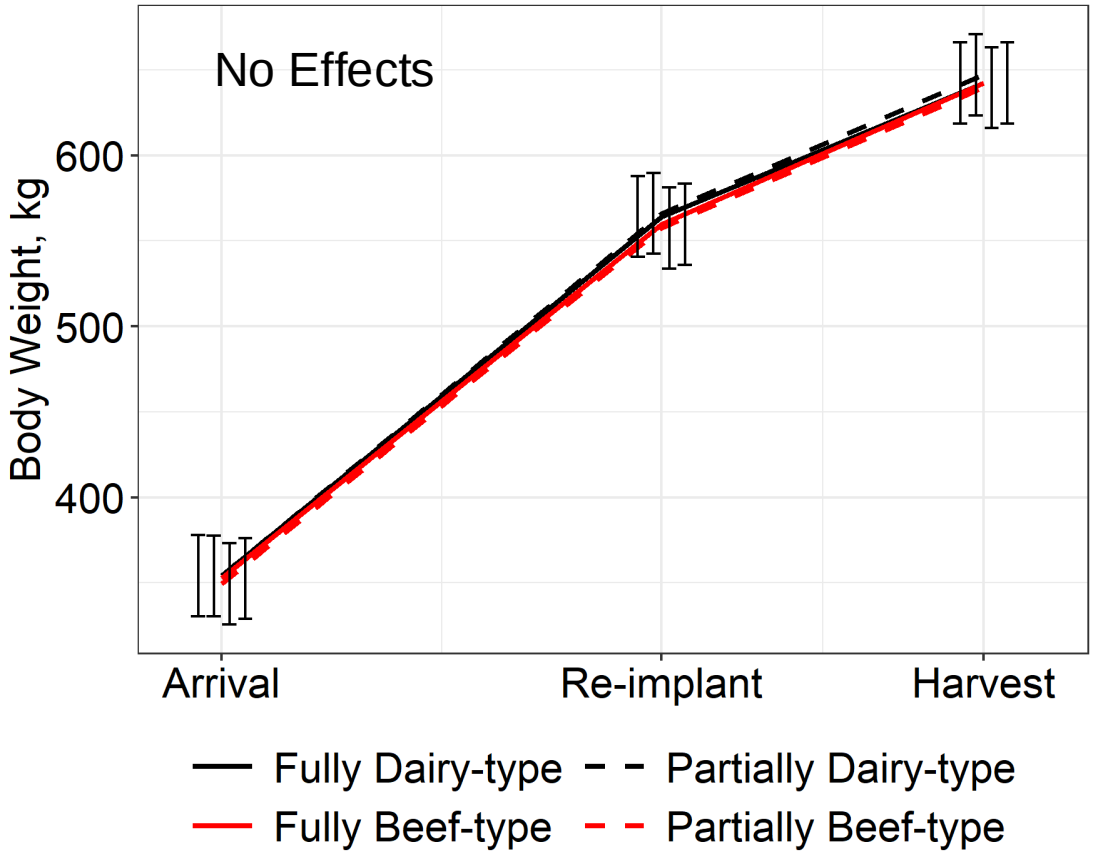
Processing Time	Days on Feed	BW, lbs
Arrival	0	777
Re-Implant	104	1,234
Harvest	180	1,417



Muscling: 1 (dairy) to 9 (beef)
Frame size: 1 (dairy) to 9 (beef)
Phenotype score = muscling + frame size

Phenotype Groups



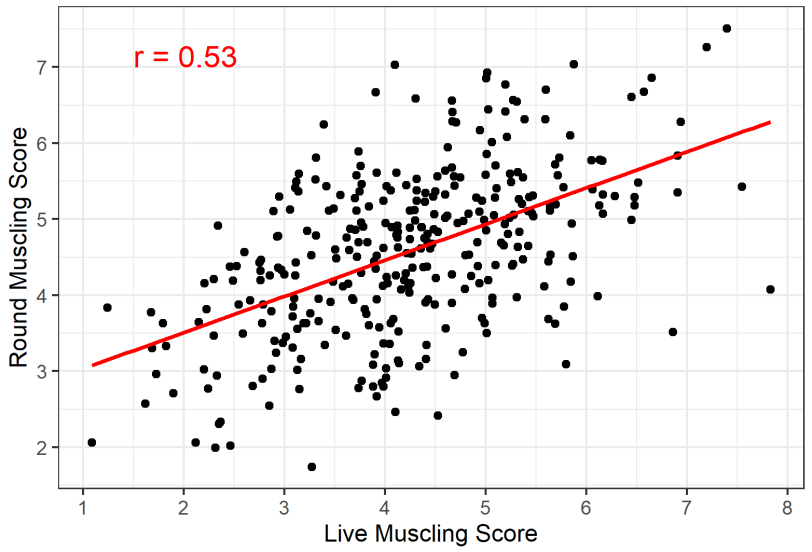


No difference (P = 0.81) in marbling score between phenotype groups (means ranged from 480 to 493).

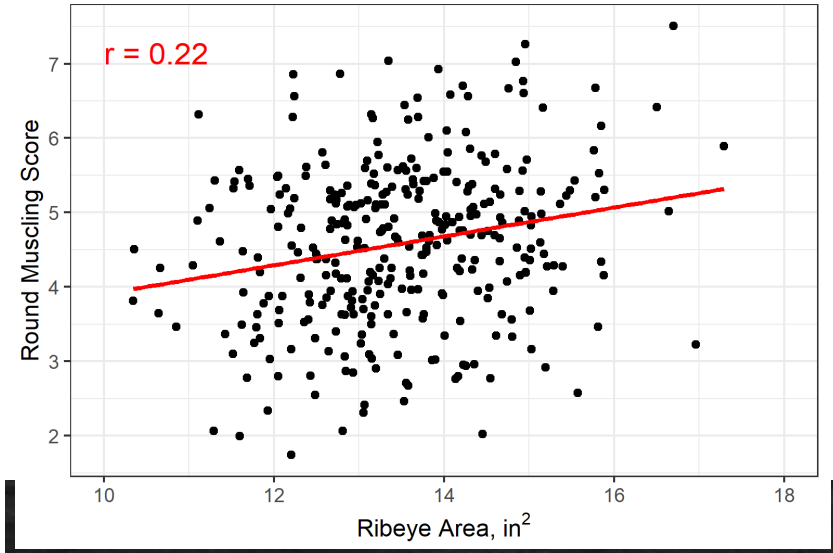
Muscling Considerations

Trait	Fully Dairy-type	Partially Dairy-type	Partially Beef-type	Fully Beef-type	*P*-value
Live muscling score	2.8^{d}	4.0^{c}	4.5^{b}	5.6^{a}	<0.01
Ribeye area, in^2	13.2	13.5	13.6	13.5	0.30
Round muscling score	3.8^{c}	4.5^{bc}	4.8^{ab}	5.3^{a}	<0.01

After adjusting for pen effects and to a constant HCW of 894 lbs



After adjusting for pen effects and to a constant HCW of 894 lbs

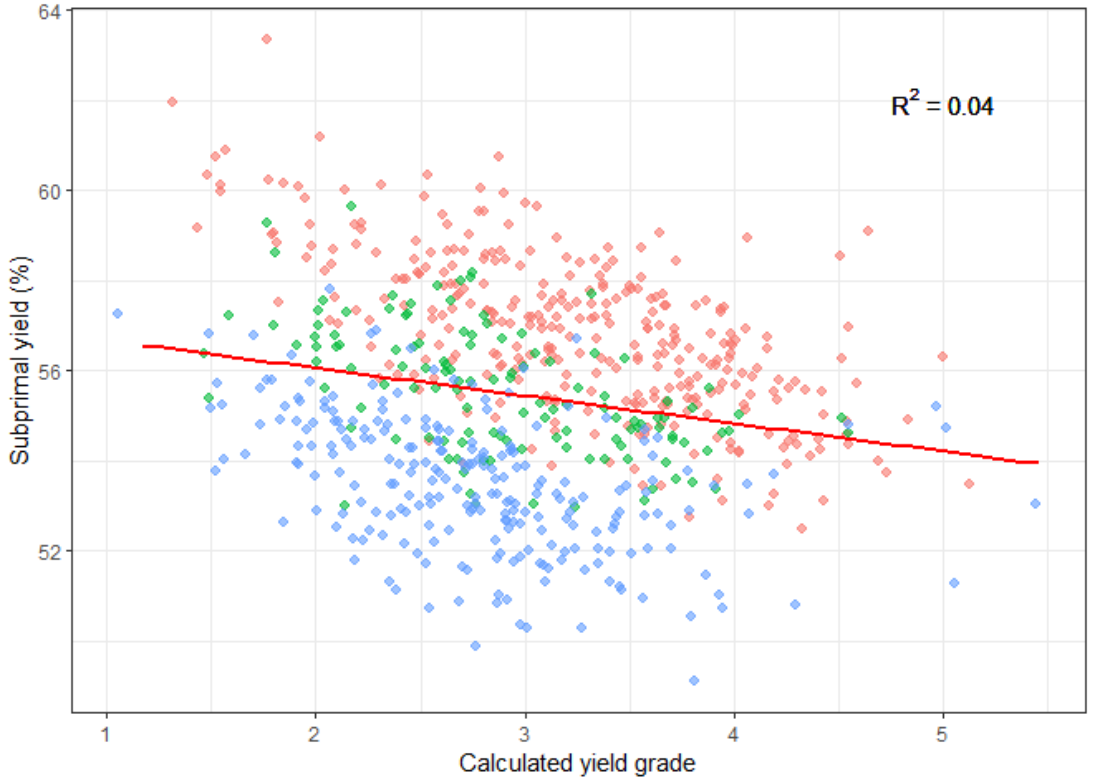


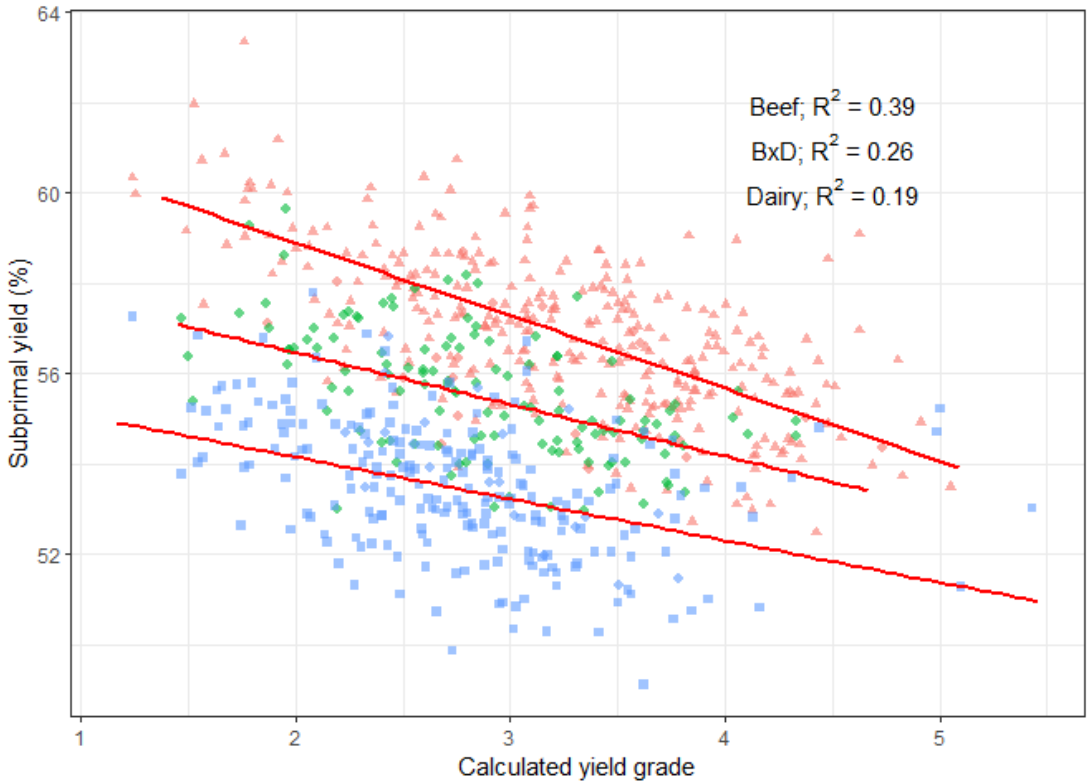
FEEDING QUALITY FORUM

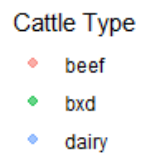
FEEDING QUALITY FORUM

Weight:	1480 lbs	1510 lbs
12th Rib Fat:	0.68 in	0.64 in
Ribeye Area:	18.2 sq in	18.7 sq in
Yield Grade:	2.4	2.2
Quality Grade:	Low Choice	Low Choice

Accuracy current USDA beef yield equation

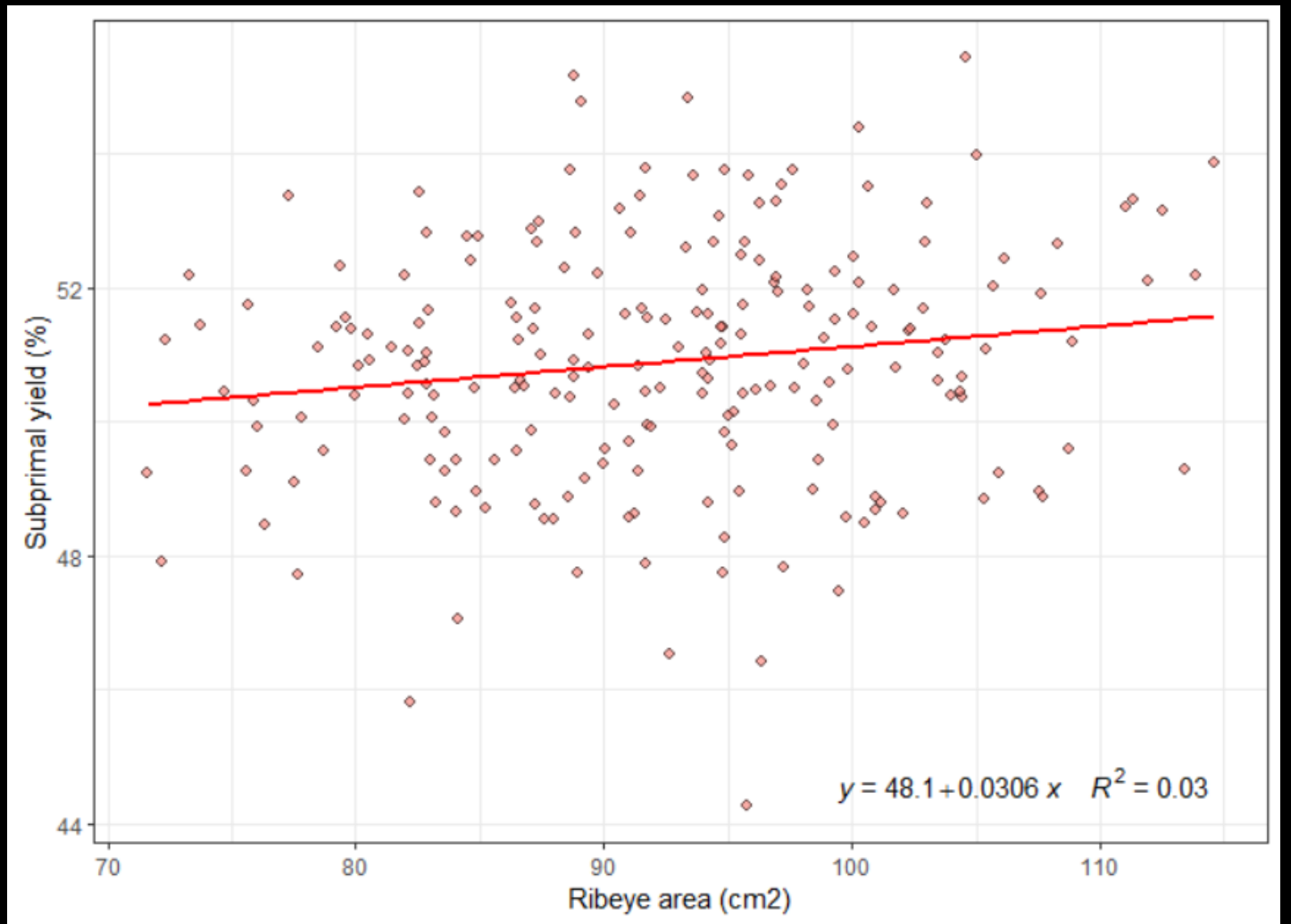




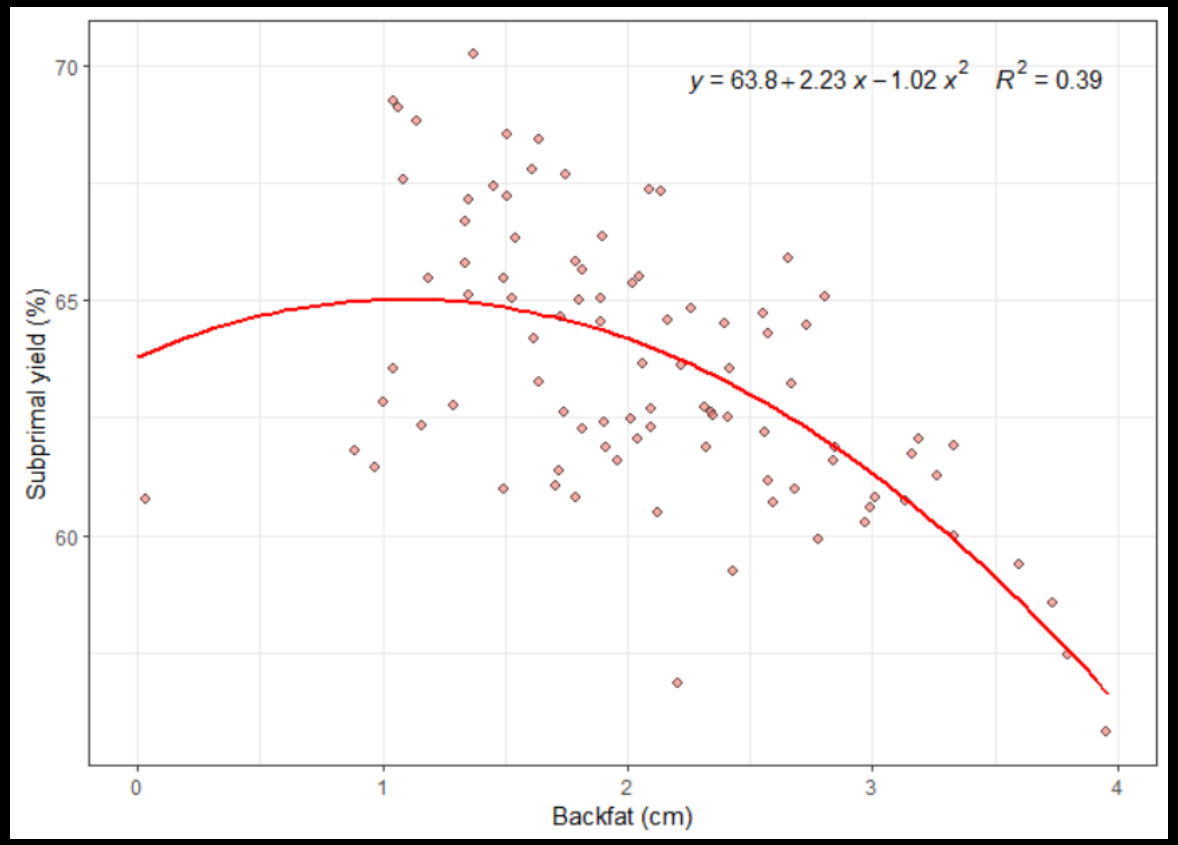


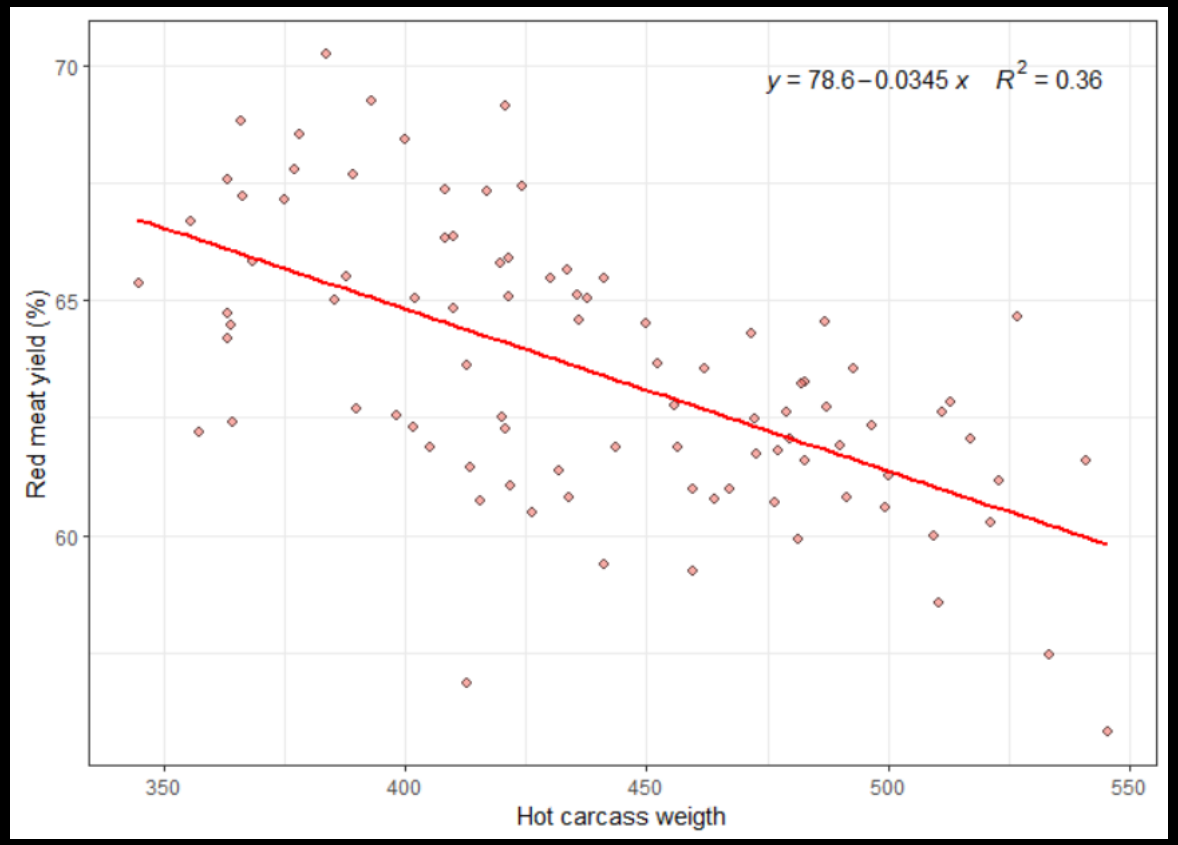
RIBEYE AREA : SUBPRIMAL YIELD

- 3% VARIATION EXPLAINED AS A SINGLE FACTOR

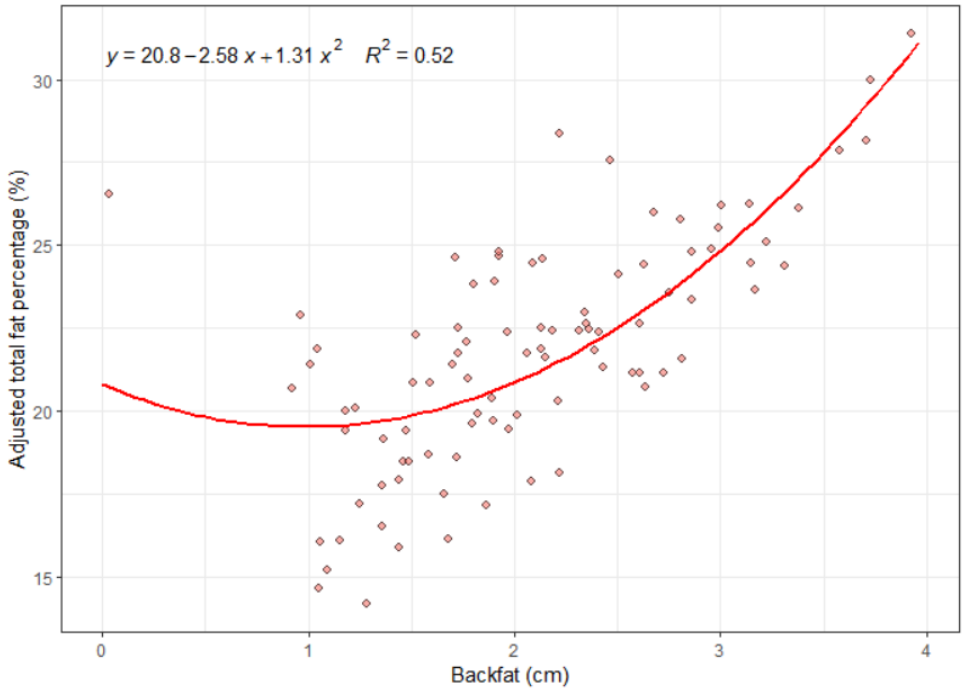


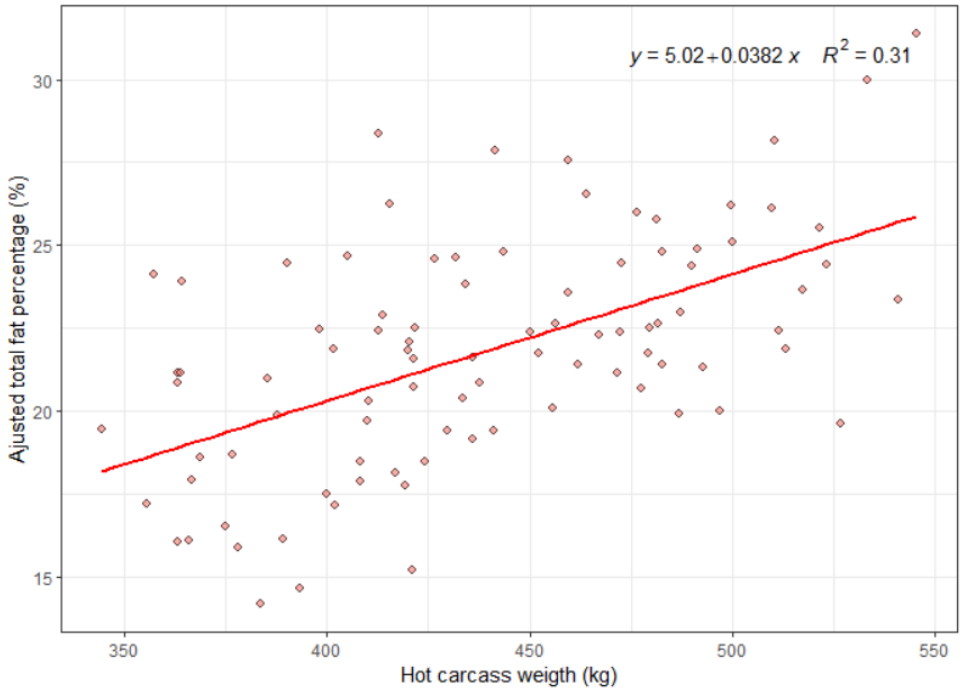
Regression analysis (RMY ~ Current USDA predictors)





Regression analysis
(Total adjusted fat (%) ~ Current USDA predictors)

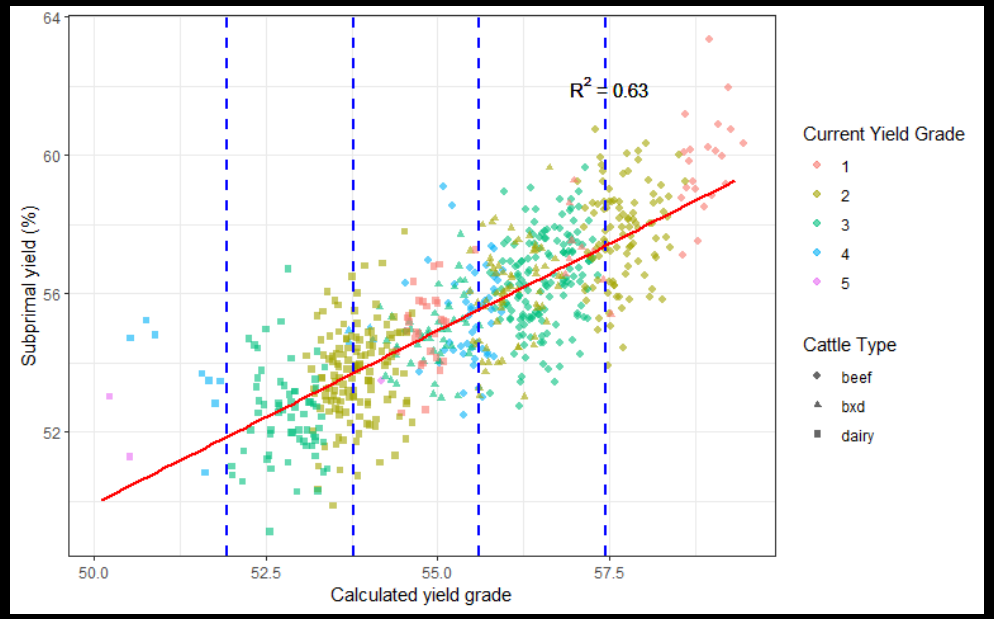


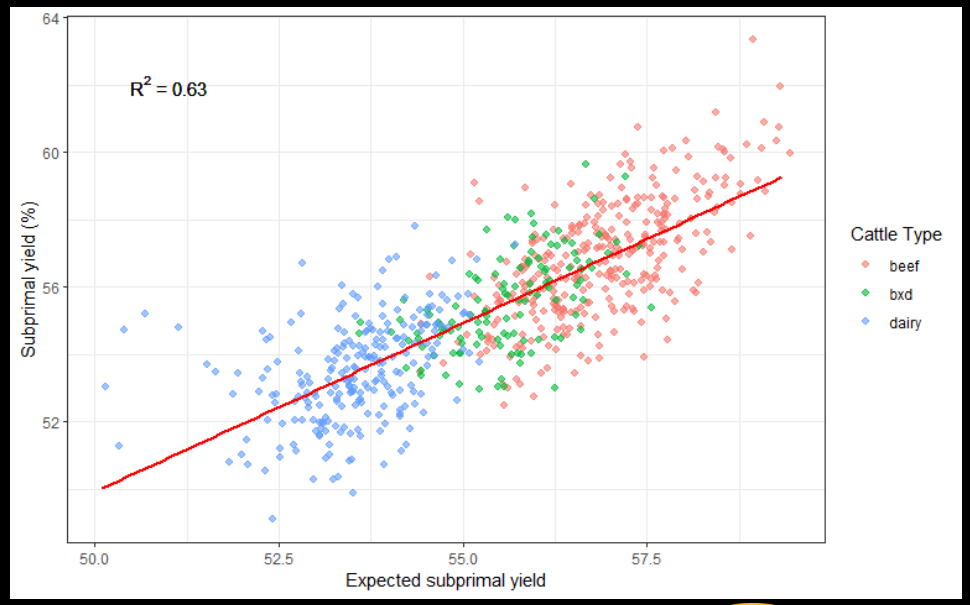


Accuracy modified subprimal yield equation ~ Adjusted for cattle type

Subprimal yield = 56.94+(0.40*REA)–(0.0042*HCW)–(3.57*FT)

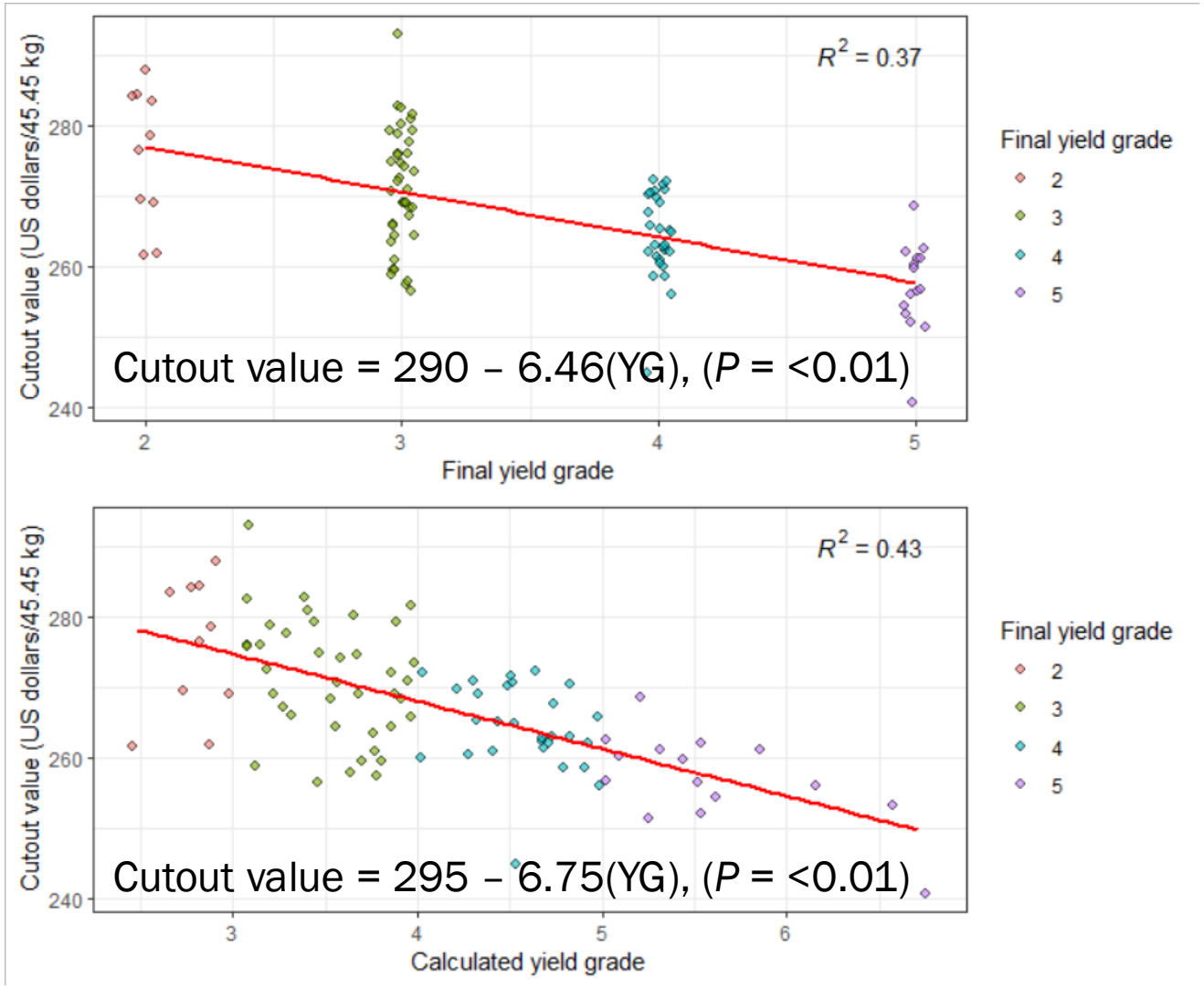
- Beef Adjustment = 0 (baseline)
- BeefxDairy Adjustment = -1.76
- Dairy Adjustment = -4.02

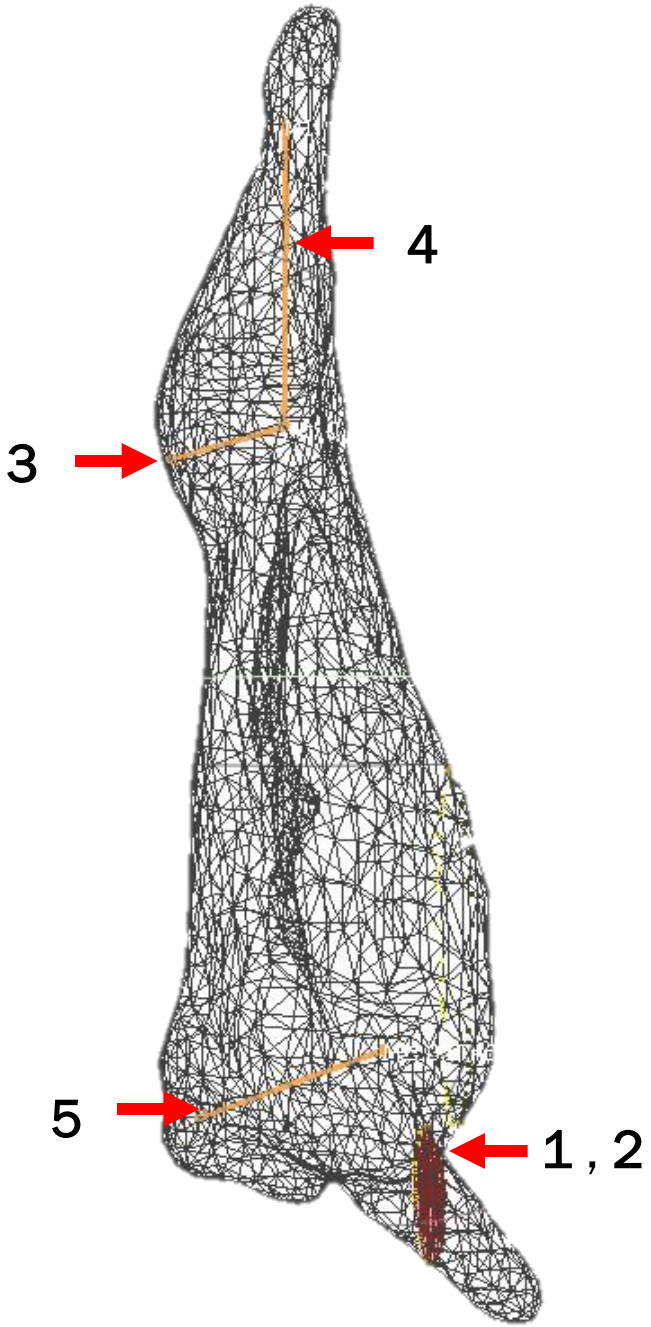




FEEDING QUALITY FORUM

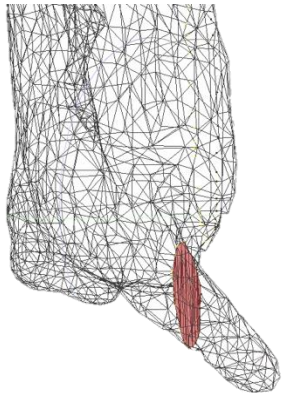
Saleable Yield Estimates by Updated YG



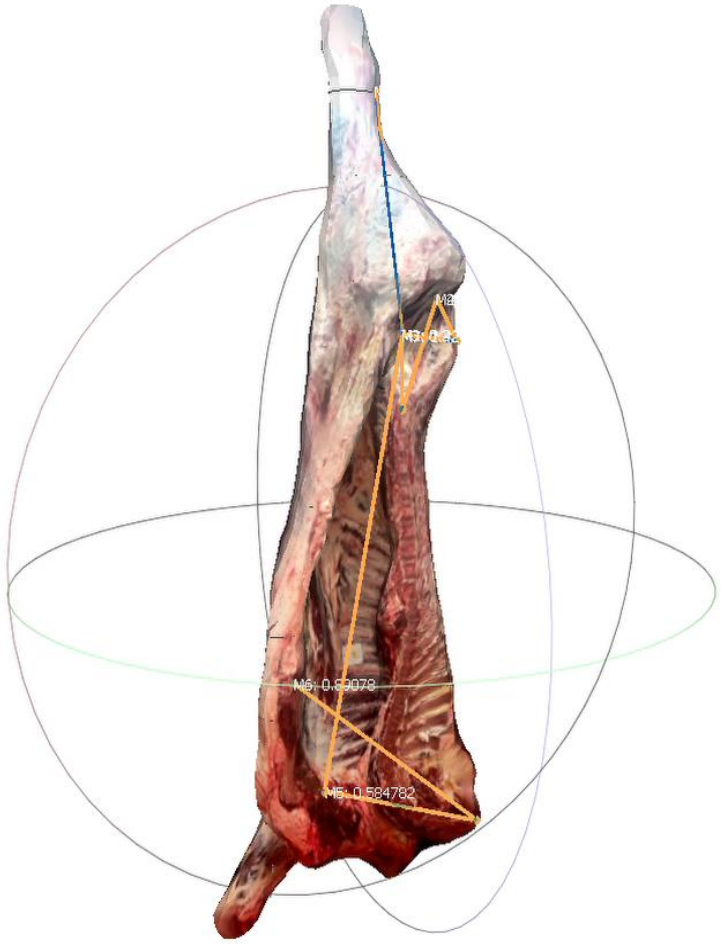


1. Foreshank area

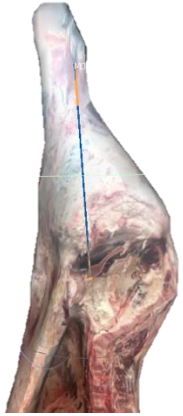
2. Foreshank perimeter



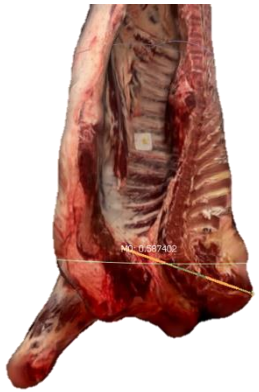
3. Sirloin width



4. Round length



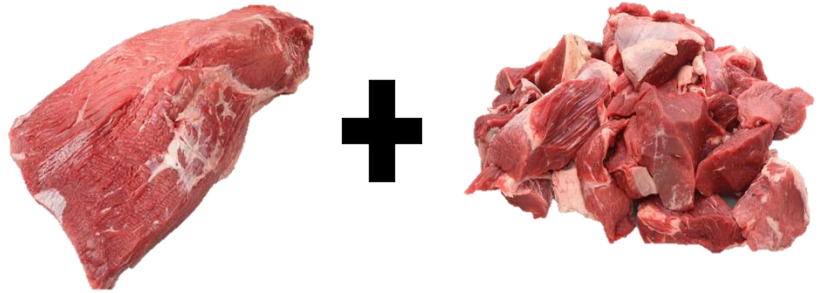
5. Chuck Length



N	Predictors	R^2	Adjusted R^2	CP	AIC
1	Comp.7	0.27	0.22	45.11	83.40
2	Comp.4 Comp.7	0.50	0.43	28.54	78.86
3	Comp.1 Comp.4 Comp.7	0.62	0.53	21.48	76.43
4	Comp.1 Comp.4 Comp.7 Comp.12	0.72	0.63	15.03	72.92
5	Comp.1 Comp.3 Comp.4 Comp.7 Comp.12	0.80	0.71	10.99	69.47
6	Comp.1 Comp.3 Comp.4 Comp.6 Comp.7 Comp.12	0.87	0.80	6.97	63.43
7	Comp.1 Comp.3 Comp.4 Comp.6 Comp.7 Comp.9 Comp.12	0.93	0.88	4.53	55.42
8	Comp.1 Comp.3 Comp.4 Comp.6 Comp.7 Comp.9 Comp.11 Comp.12	0.95	0.89	5.30	53.12
9	Comp.1 Comp.3 Comp.4 Comp.6 Comp.7 Comp.9 Comp.10 Comp.11 Comp.12	0.96	0.91	6.25	50.39
10	Comp.1 Comp.2 Comp.3 Comp.4 Comp.6 Comp.7 Comp.9 Comp.10 Comp.11 Comp.12	0.96	0.89	8.16	51.88
11	Comp.1 Comp.2 Comp.3 Comp.4 Comp.6 Comp.7 Comp.8 Comp.9 Comp.10 Comp.11 Comp.12	0.96	0.88	10.09	53.50
12	Comp.1 Comp.2 Comp.3 Comp.4 Comp.6 Comp.7 Comp.8 Comp.9 Comp.10 Comp.11 Comp.12 Comp.13	0.96	0.85	12.04	55.25
13	Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6 Comp.7 Comp.8 Comp.9 Comp.10 Comp.11 Comp.12 Comp.13	0.96	0.80	14.00	57.02

Red meat yield prediction

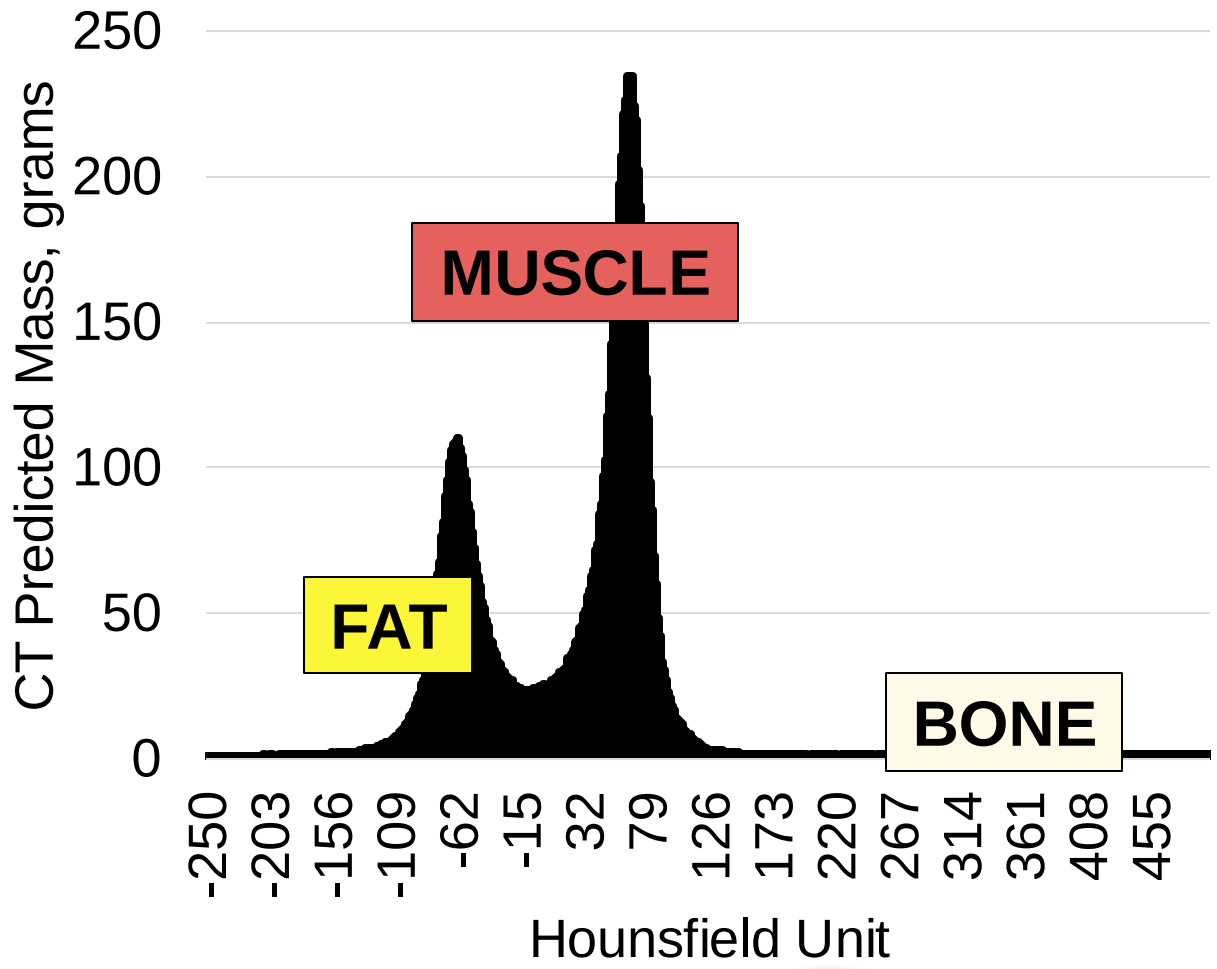
Red Meat Yield (%)



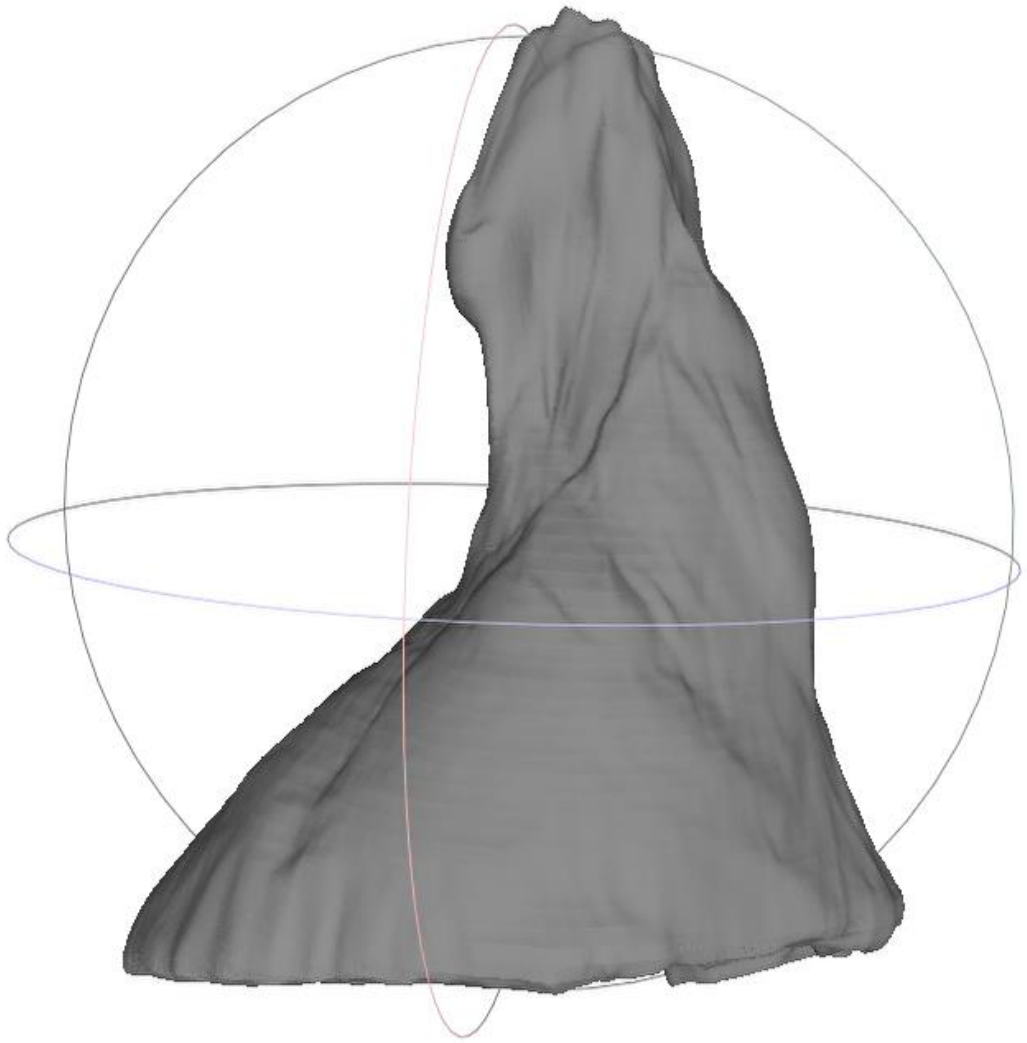
Subprimal + Trim (Adjusted to 90% lean)

Using CT to Determine Composition

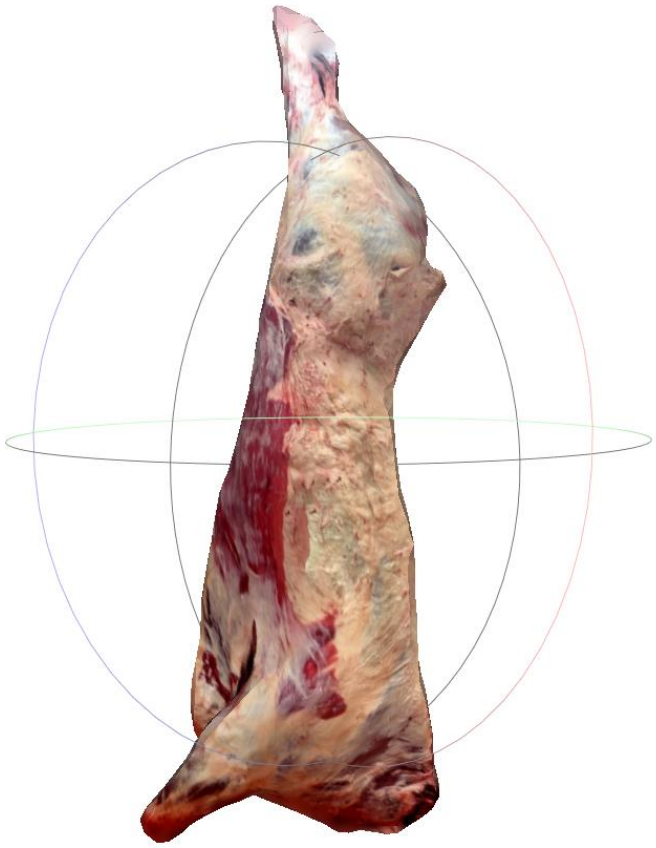
What is the gold standard for "true yield" measurement?

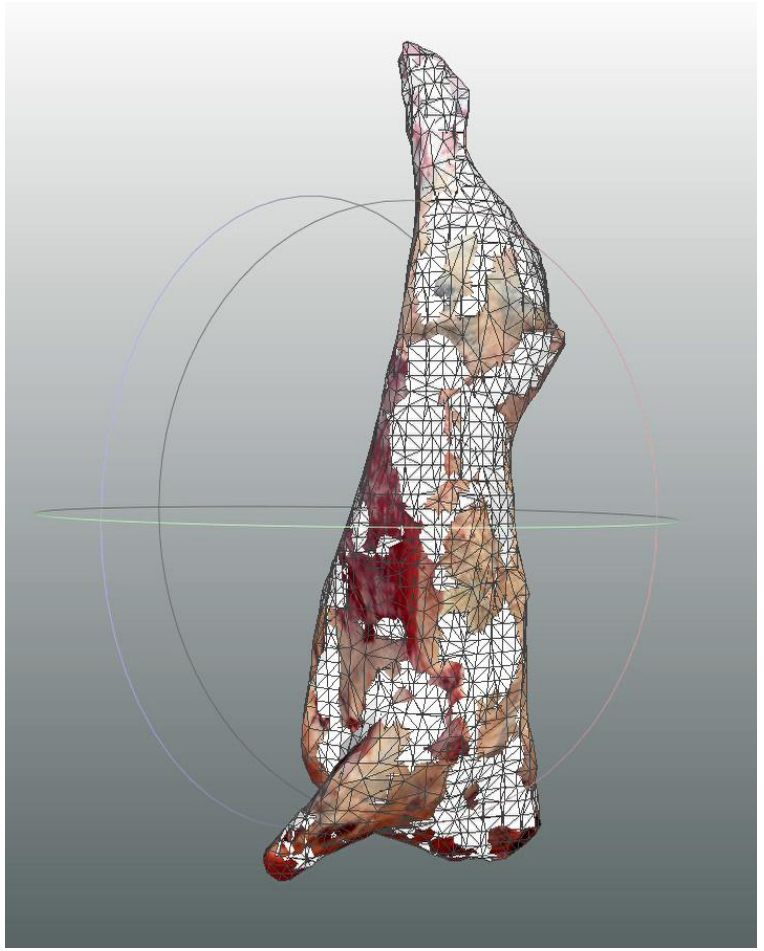


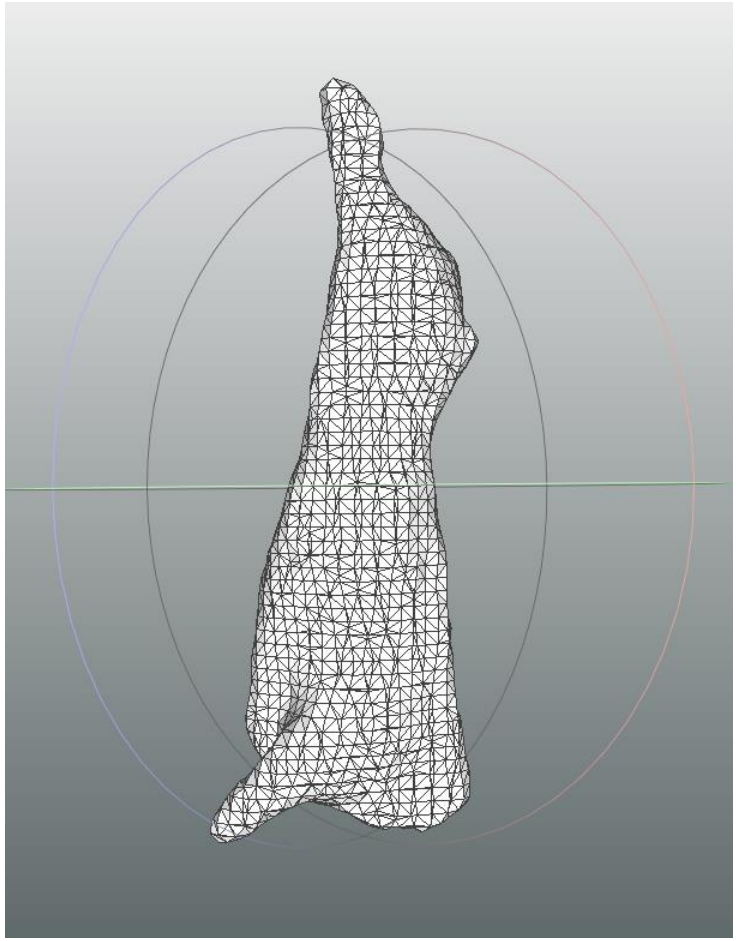
Dr. Blake Foraker - Blake.Foraker@ttu.edu



CT data for 3D rendering





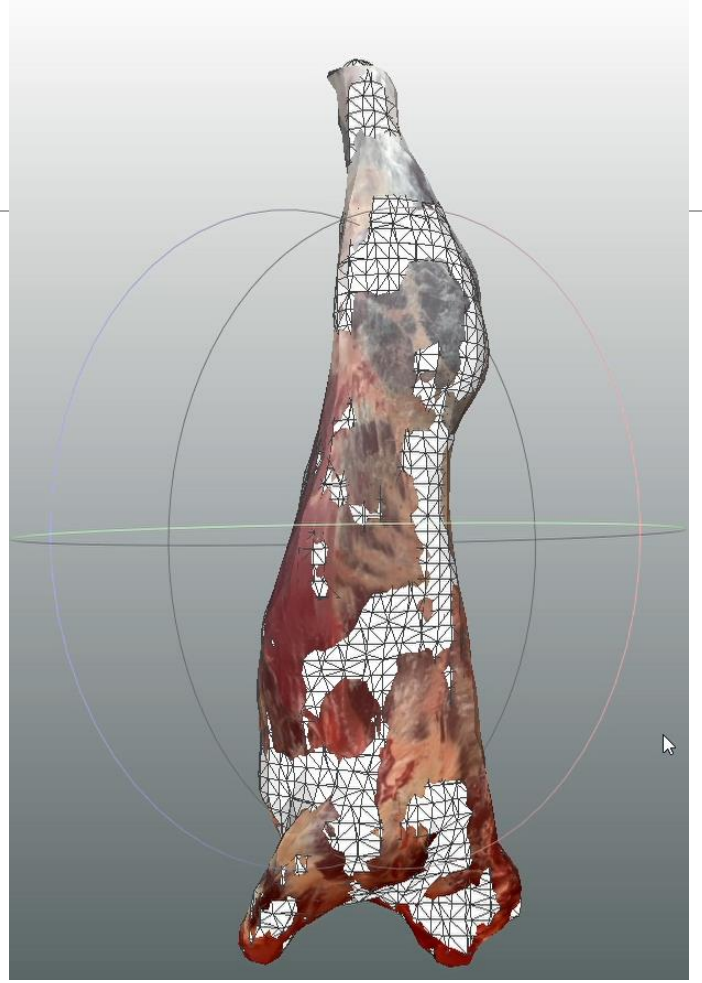


RMY = 60.32%

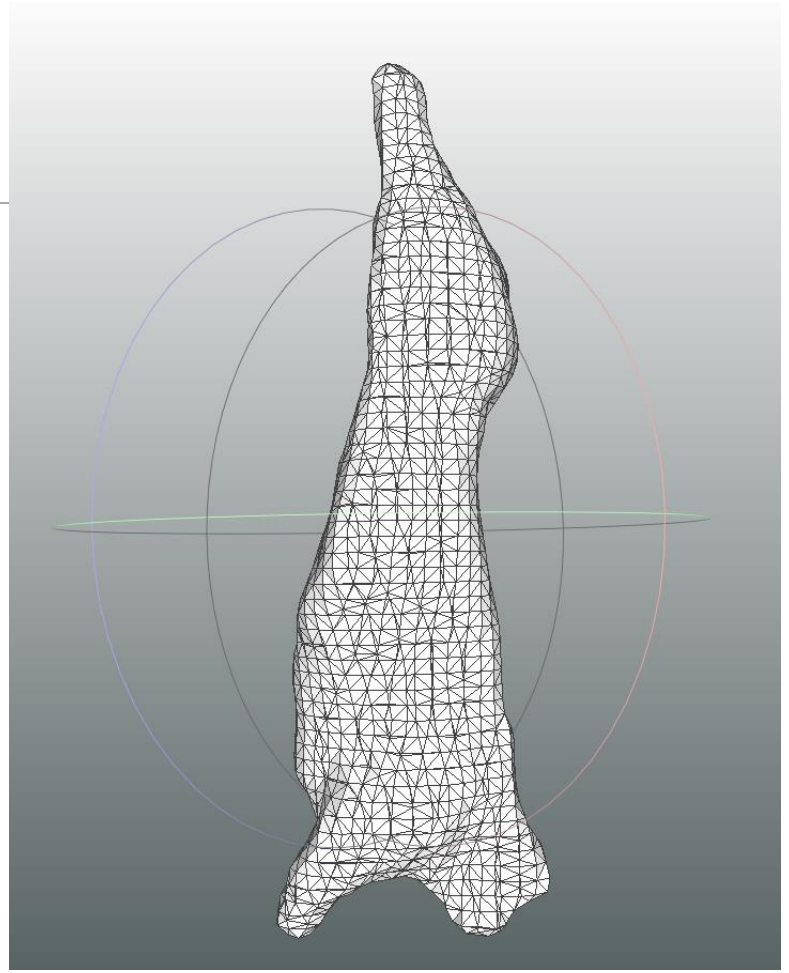
Data Augmentation

RMY = 61.42%

RMY = 71.46%



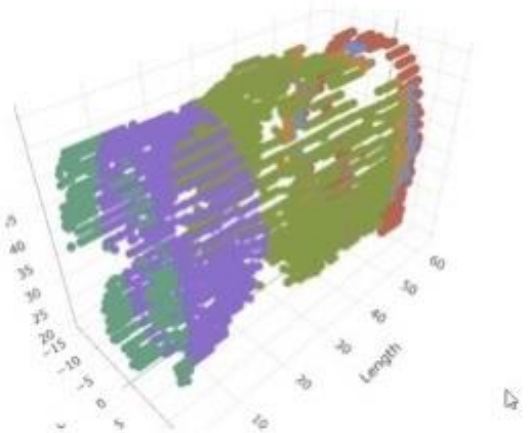
Data Augmentation



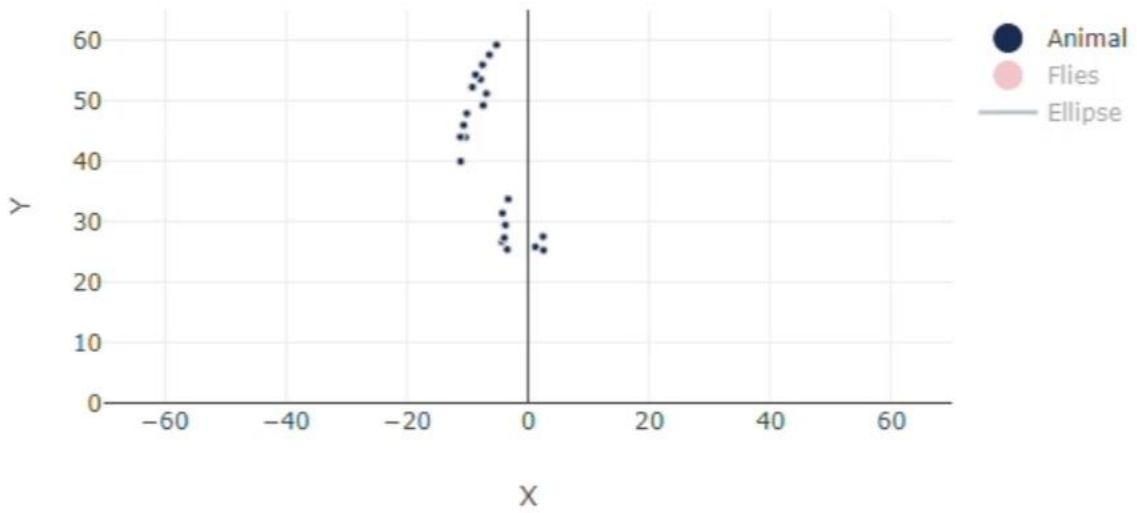
RMY = 71.74%

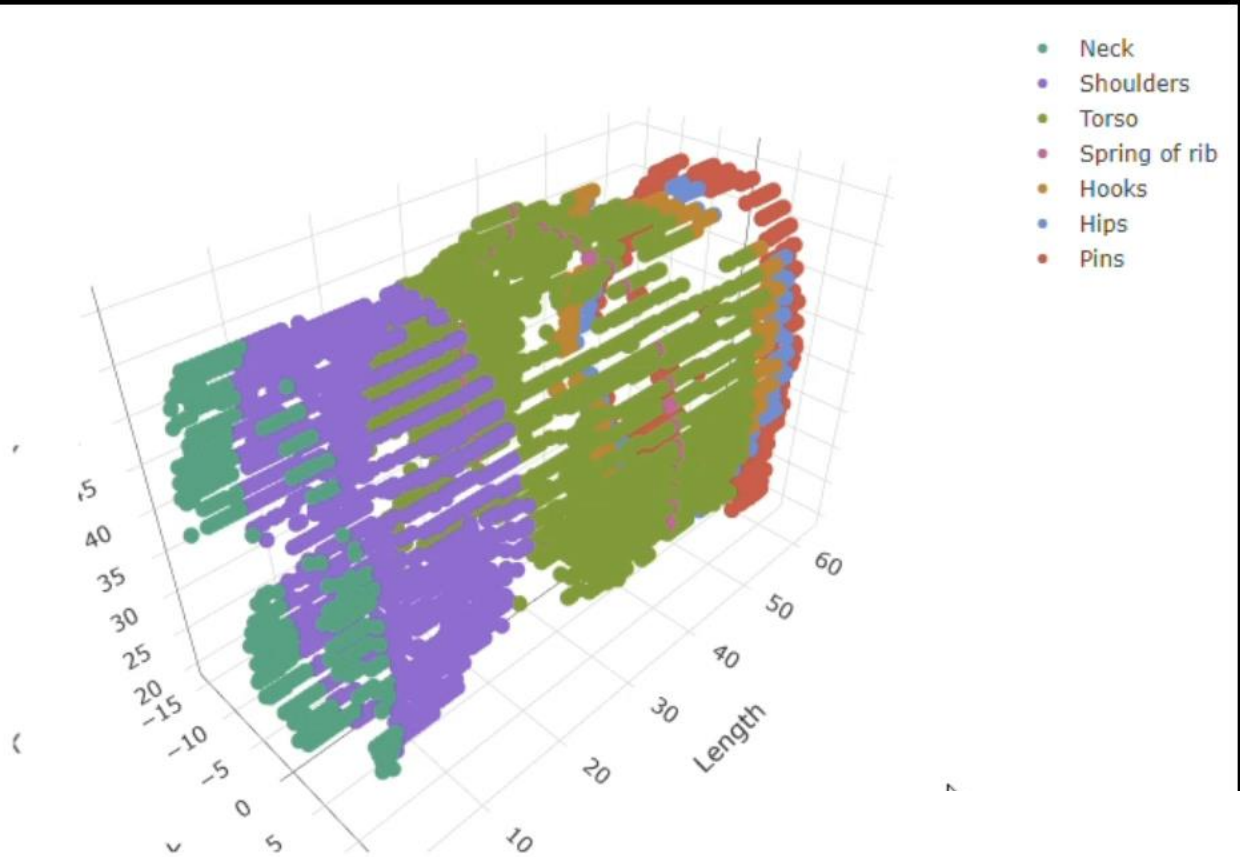
Measuring Morphology of Live Cattle

sizeR™
PRECISION RADAR BODY MEASUREMENT
0 1 2 3 4 5 6



Dr. Blake Foraker - Blake.Foraker@ttu.edu



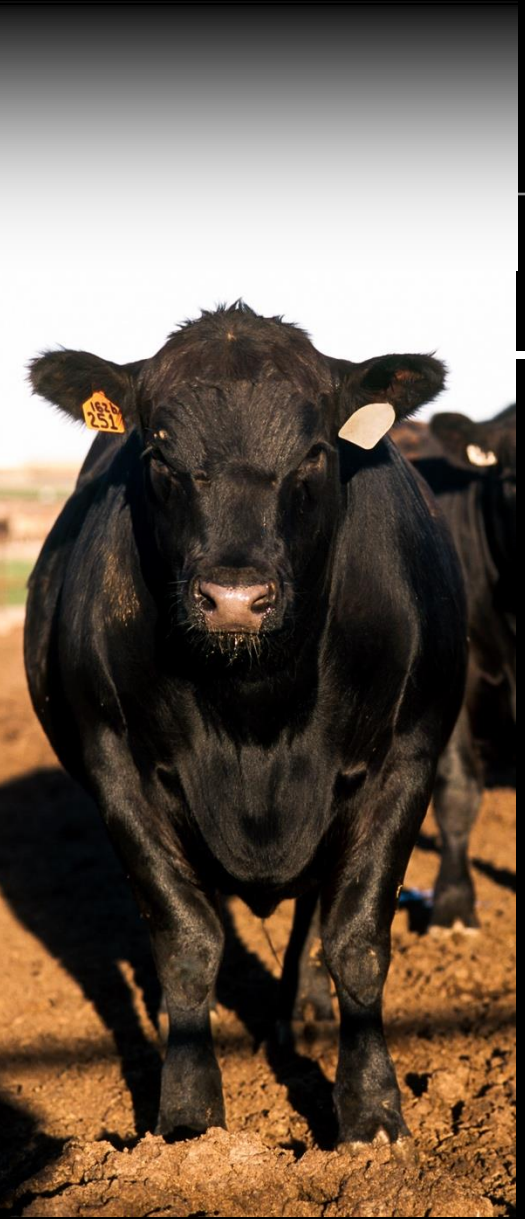


sizeR™
PRECISION RADAR BODY MEASUREMENT

Dr. Blake Foraker - Blake.Foraker@ttu.edu

U.S. BEEF INDUSTRY "Sustainability Plan"

FEEDING QUALITY FORUM



Embrace Technology

Increase Yields

- Improve Feed Efficiency
- Reduce Emissions
- Reduce Water Loss

Improve Sustainability

PEPSI'S 1990- HEALTH CRAZE PLAN

"It would have been nice if I'd made sure the product tasted good."

- David Novak, Credited with creating Pepsi Crystal

Remove Caffeine

Reduce Calories

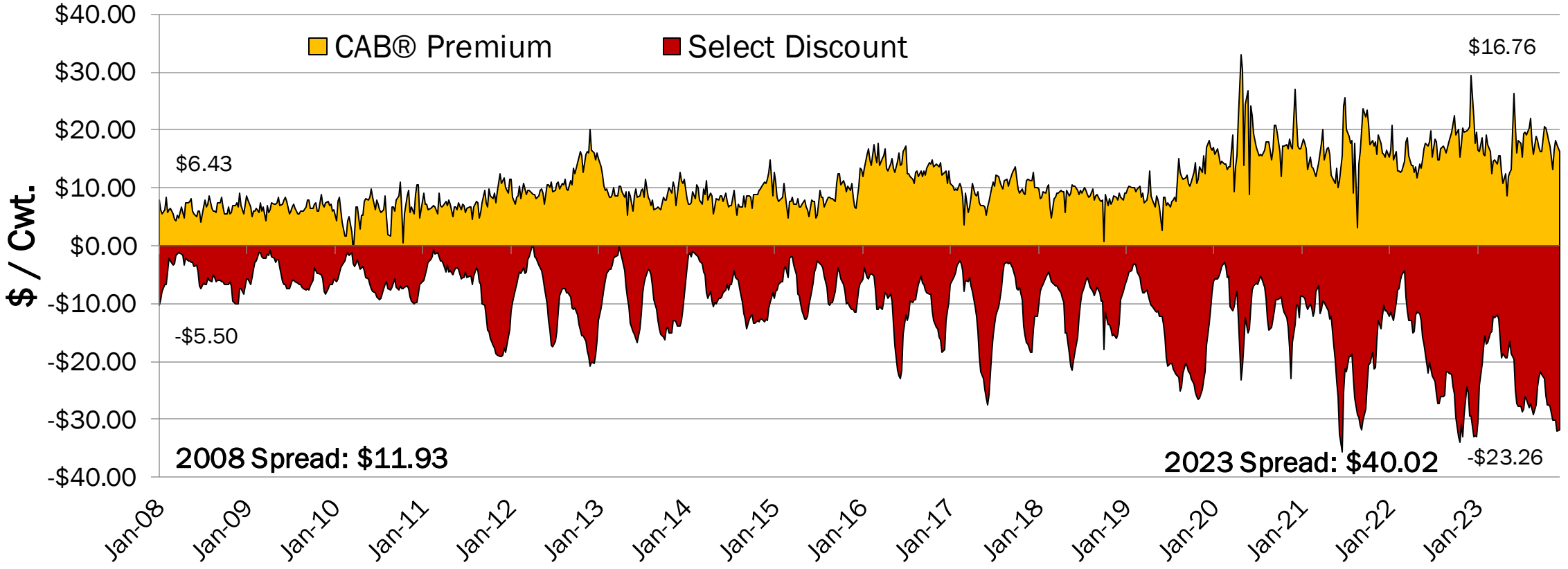
"You've Never Seen a Taste Like this!"

FEEDING QUALITY FORUM

Consumers Want Quality

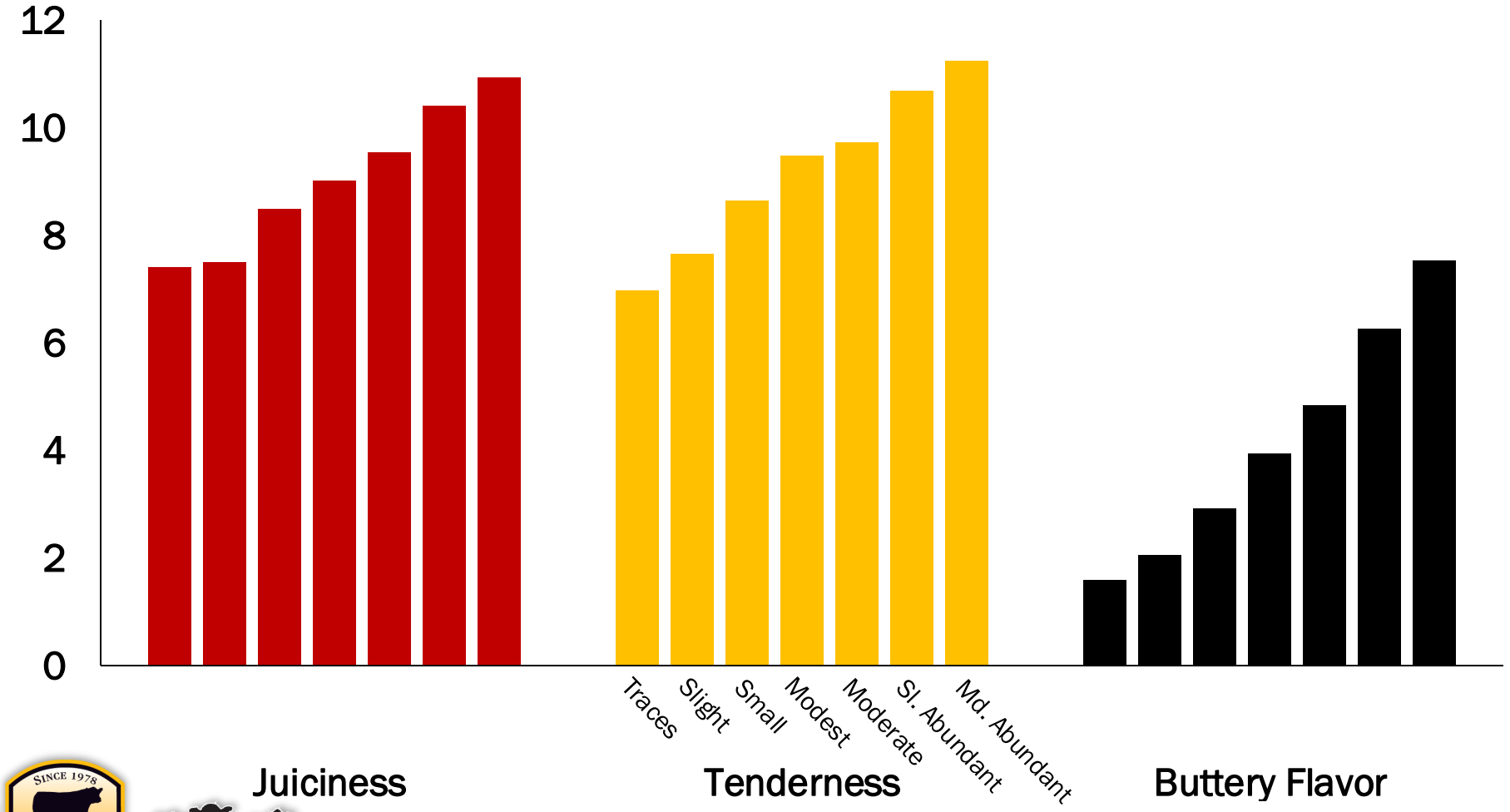
FEEDING QUALITY FORUM

Carcass Cutout Values in Relation to Choice



Source: Urner Barry

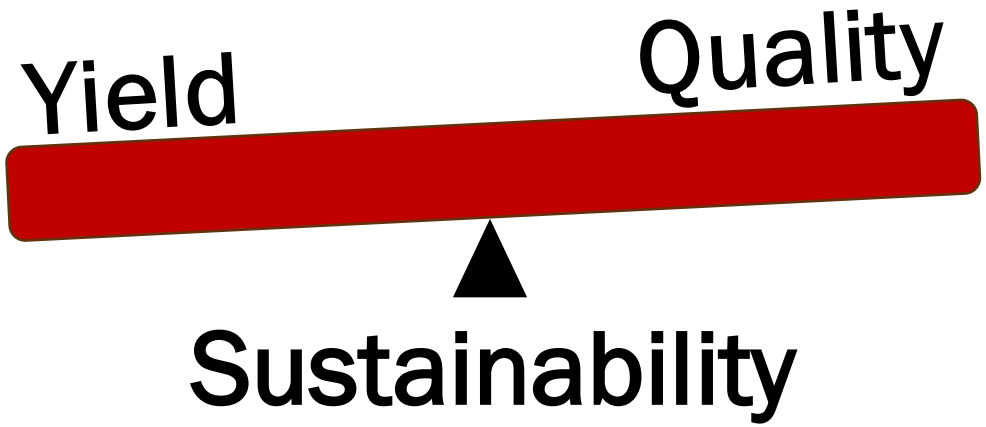
The effect of Marbling on Sensory Traits



FEEDING QUALITY FORUM

Emmerson et al. 2013. J Anim Sci. 91: 1024-1034.

Beef Quality ~~vs.~~ *with* Yield



Vs.

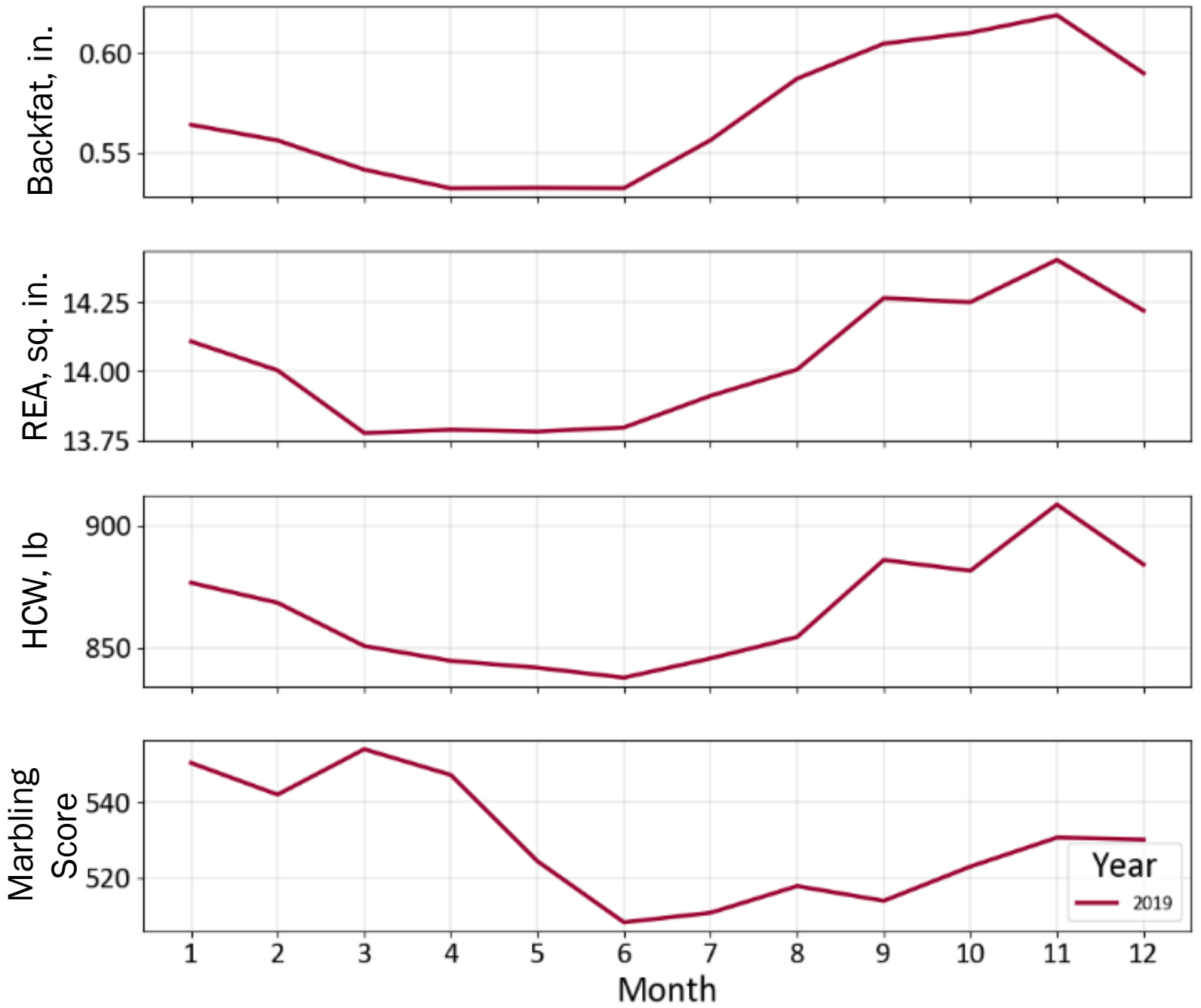
SINCE 1978
CERTIFIED ANGUS BEEF® BRAND
FEEDING QUALITY
FORUM

Look Back to Plan Forward

- Consist Study

Calendar Year	Head Count
2019	2.32 M
2020	3.75 M
2022	1.77 M
2023	2.22 M

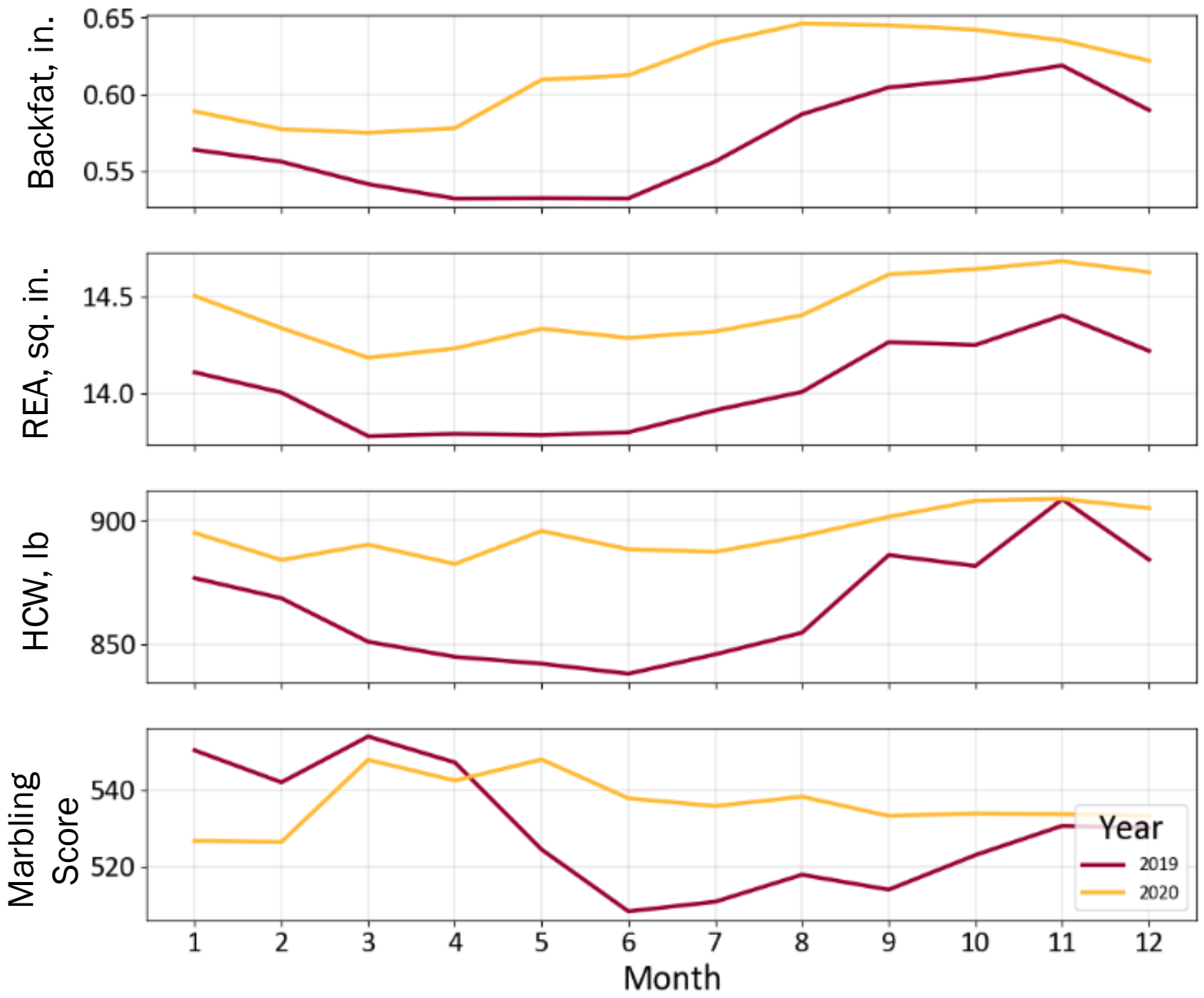
FEEDING QUALITY FORUM



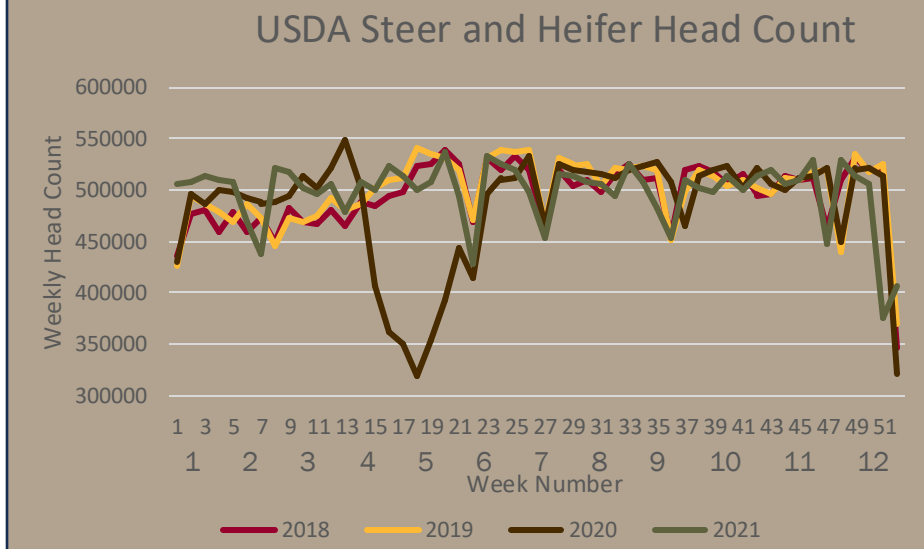
	HCW, lb	REA, sq. in.	Fat, in	Marbling Score
2019	865.8	14.1	0.58	524

SINCE 1978
CERTIFIED ANGUS BEEF® BRAND

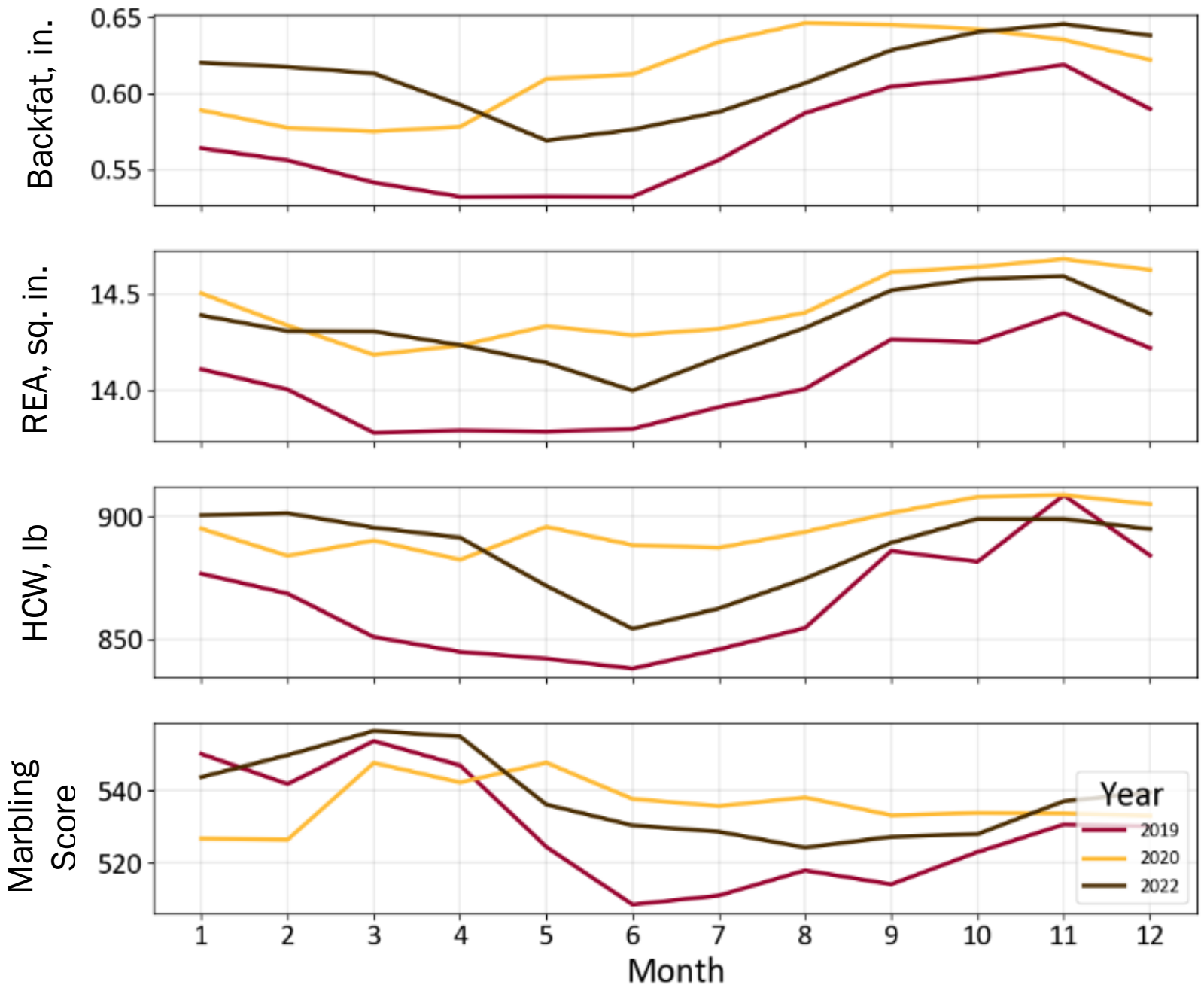
FEEDING QUALITY FORUM



	HCW, lb	REA, sq. in.	Fat, in	Marbling Score
2019	865.8	14.1	0.58	524
2020	896.6	14.5	0.62	535

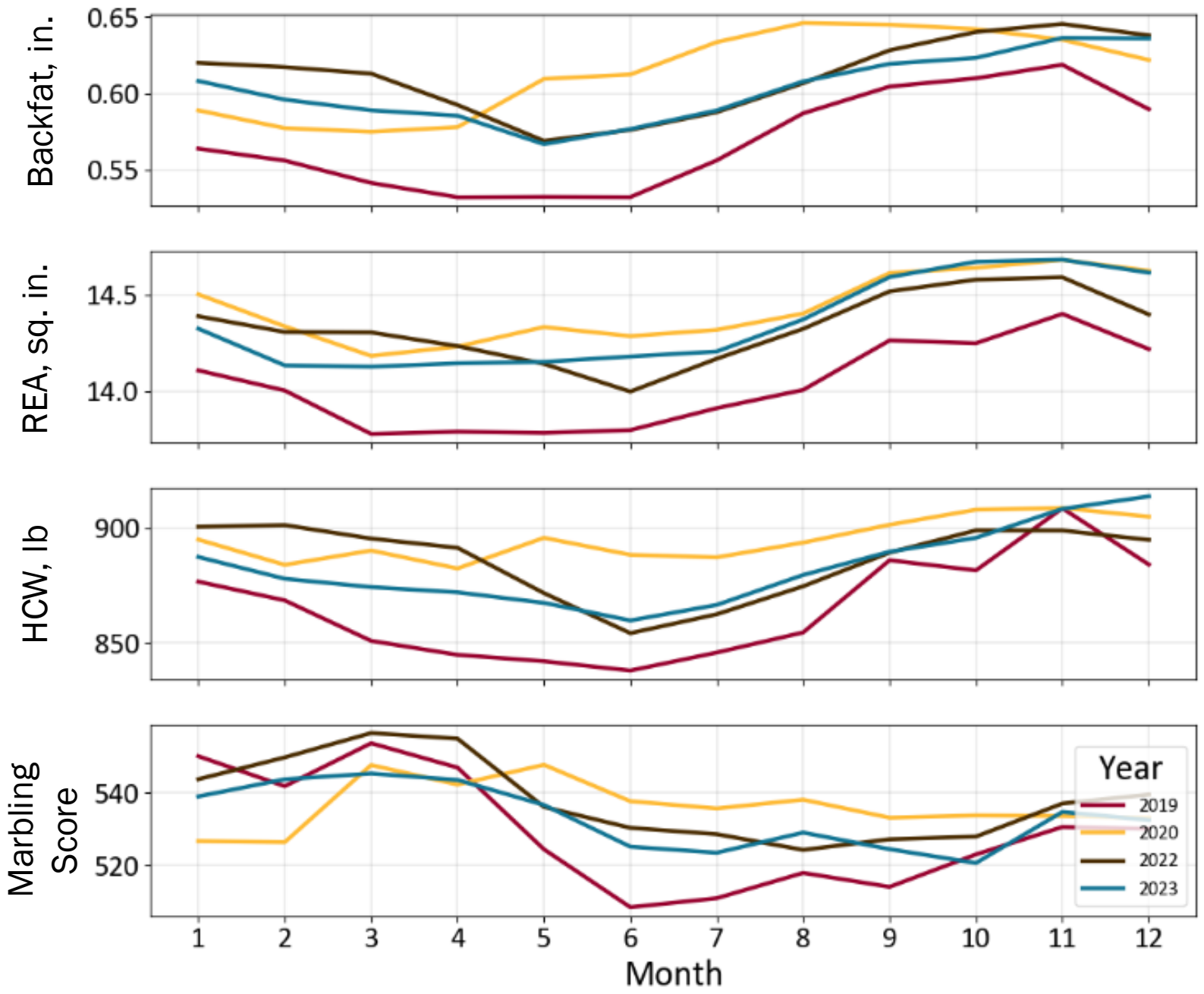


FEEDING QUALITY
FORUM



	HCW, lb	REA, sq. in.	Fat, in	Marbling Score
2019	865.8	14.1	0.58	524
2020	896.6	14.5	0.62	535
2022	885.8	14.3	0.61	538

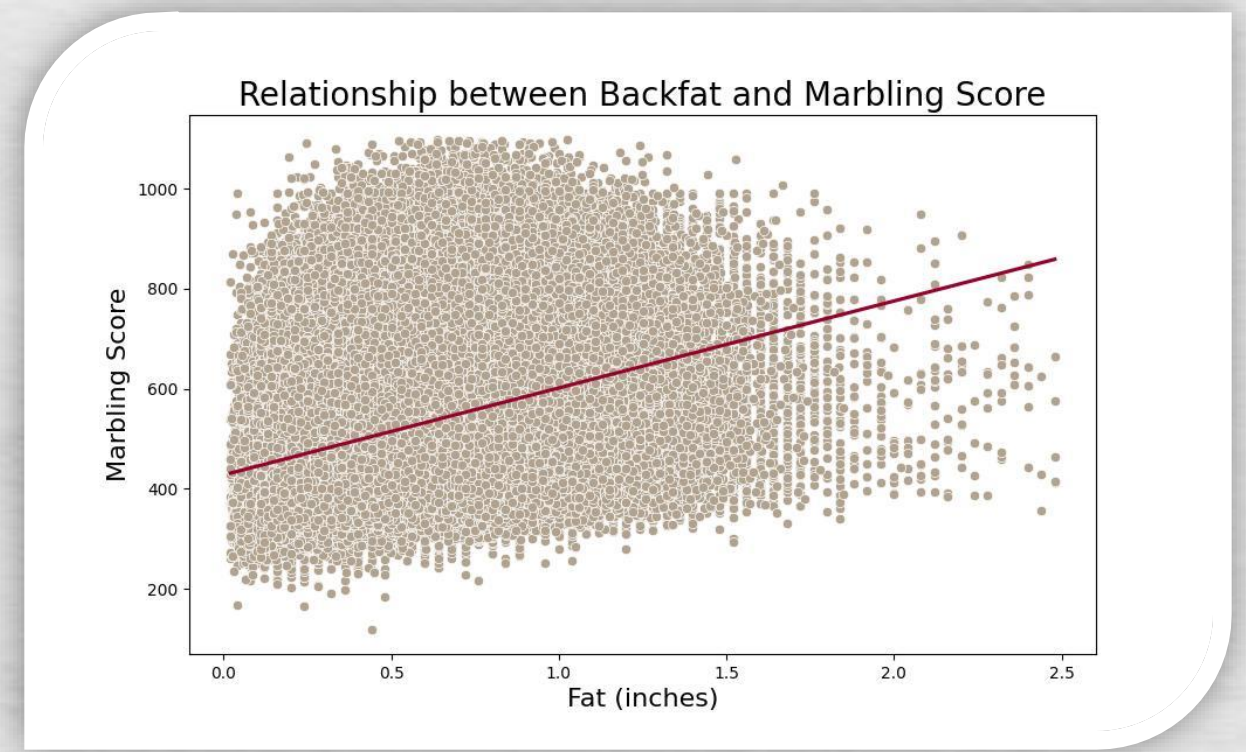
FEEDING QUALITY FORUM



	HCW, lb	REA, sq. in.	Fat, in	Marbling Score
2019	865.8	14.1	0.58	524
2020	896.6	14.5	0.62	535
2022	885.8	14.3	0.61	538
2023	882.5	14.3	0.60	533

FEEDING QUALITY FORUM

2023 Consist Data



2.22 M Head

The average amount of backfat needed for a 900 lb carcass to reach a marbling score of 500 (modest[00])

Year	Backfat
2023	0.39
2022	0.39
2020	0.44
2019	0.46

*Linear regression of marbling score against hot carcass weight, and backfat thickness.

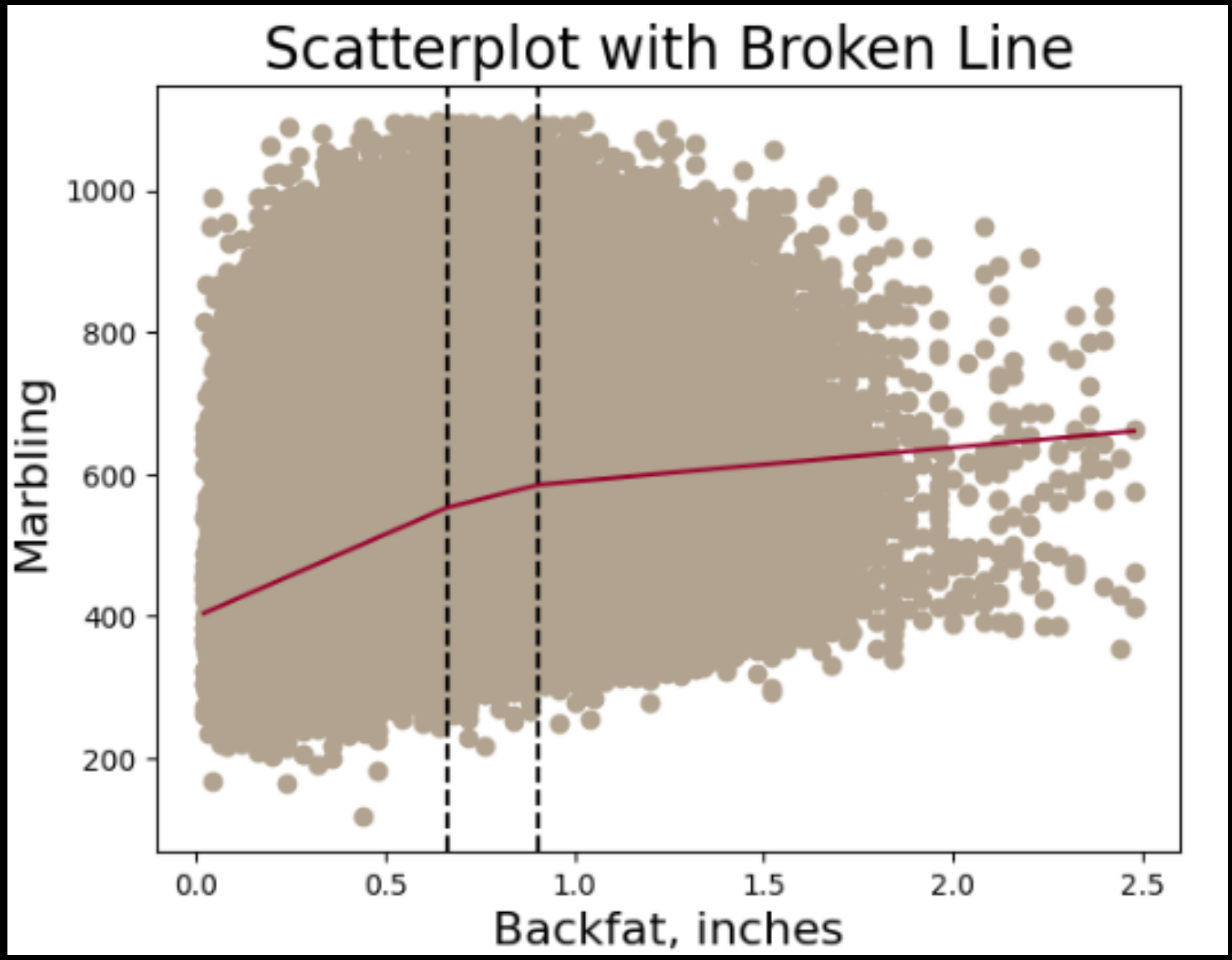
** 2019 n=2.32M, 2020 n=3.75M, 2022 n=1.77M, 2023 n=2.22M

SINCE 1978
CERTIFIED ANGUS BEEF® BRAND
FEEDING QUALITY FORUM

Marbling Score vs. Backfat

- Marbling increases with increasing backfat.
- The rate of increase slows at:
  - 0.66”
  - 0.91”

2023 Consist Data

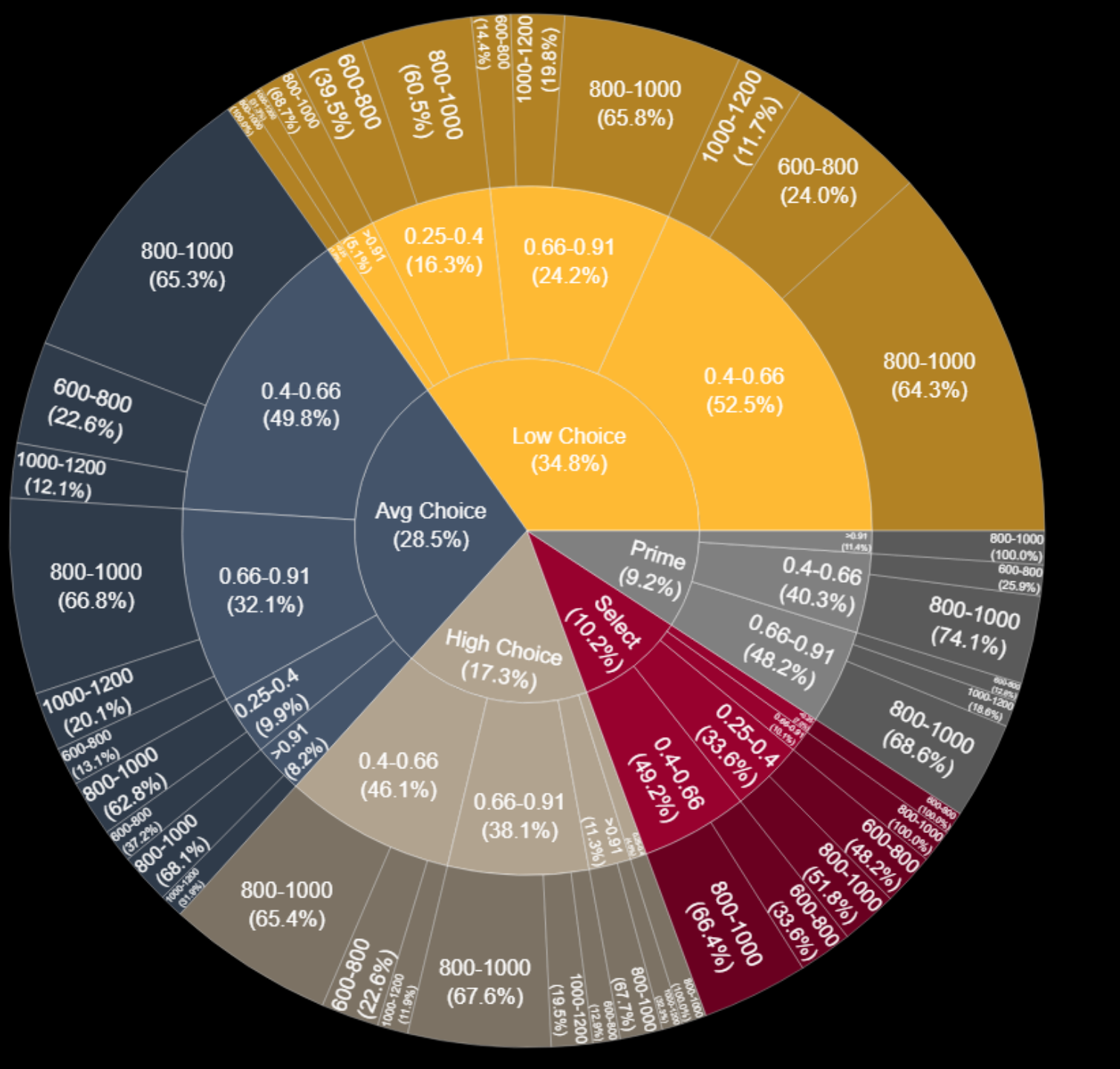


2.22 M Head

FEEDING QUALITY FORUM

2023 Consist Data

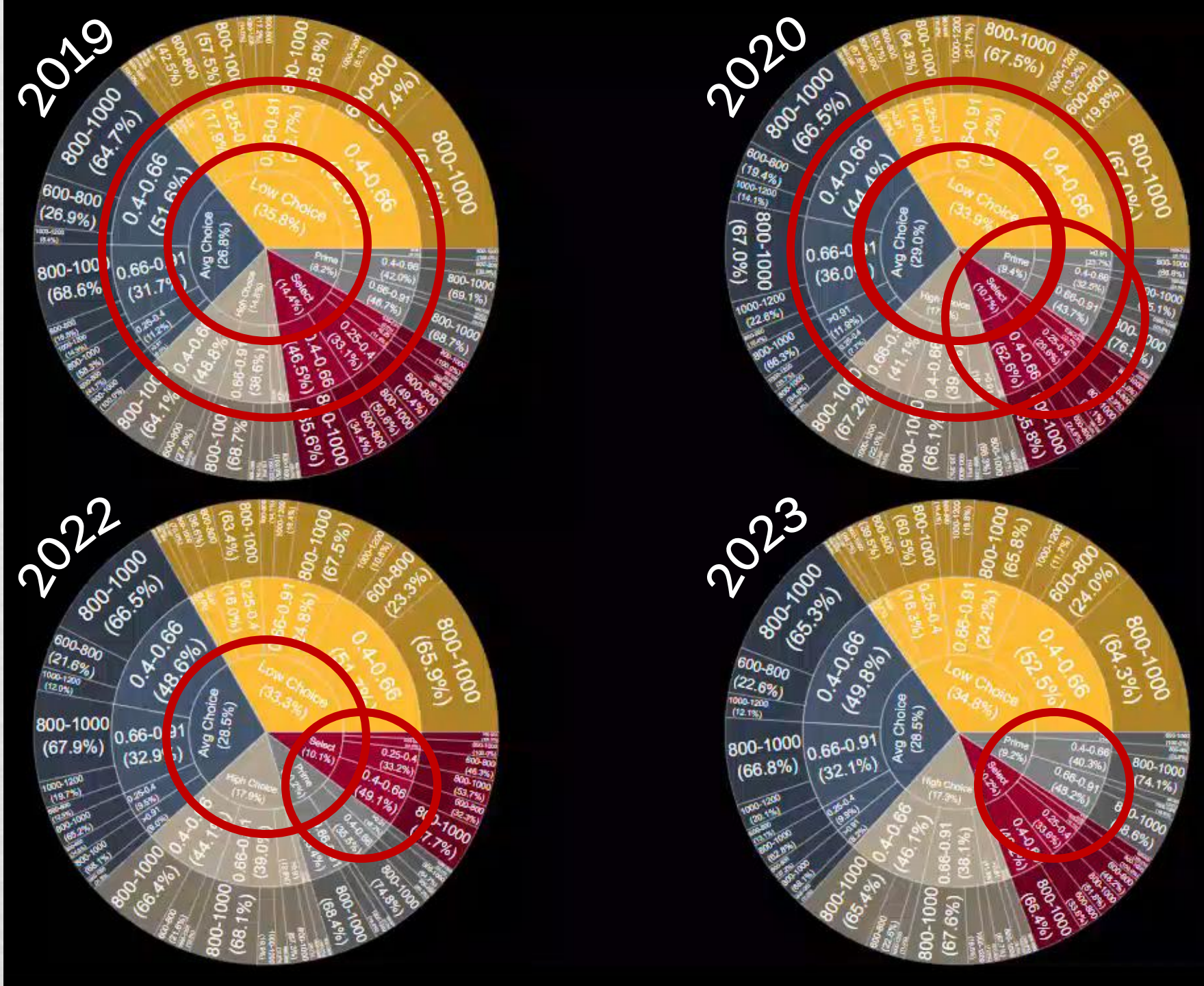
- 10.2% Select
- 34.8% Low Choice
- 28.5% Avg Choice
- 17.3% High Choice
- 9.2% Prime



FEEDING QUALITY FORUM

Key Takeaways:

- Prime production increased by 39% from 2019 to 2020
- The increase was driven by greater DOF and accompanied with greater Backfat.
- 1% increase in Prime Production from 2020 to 2022.
- Reduction in the number of cattle with >.91” backfat

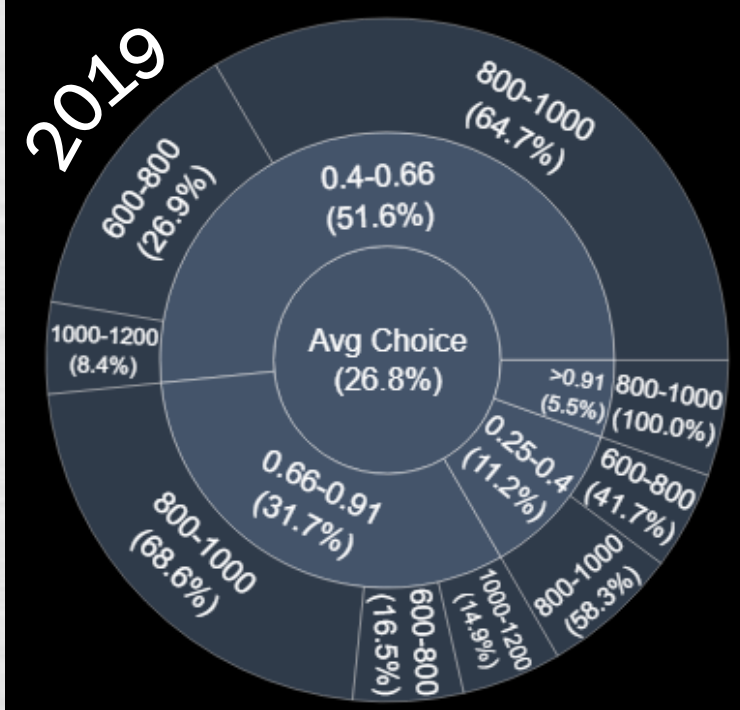


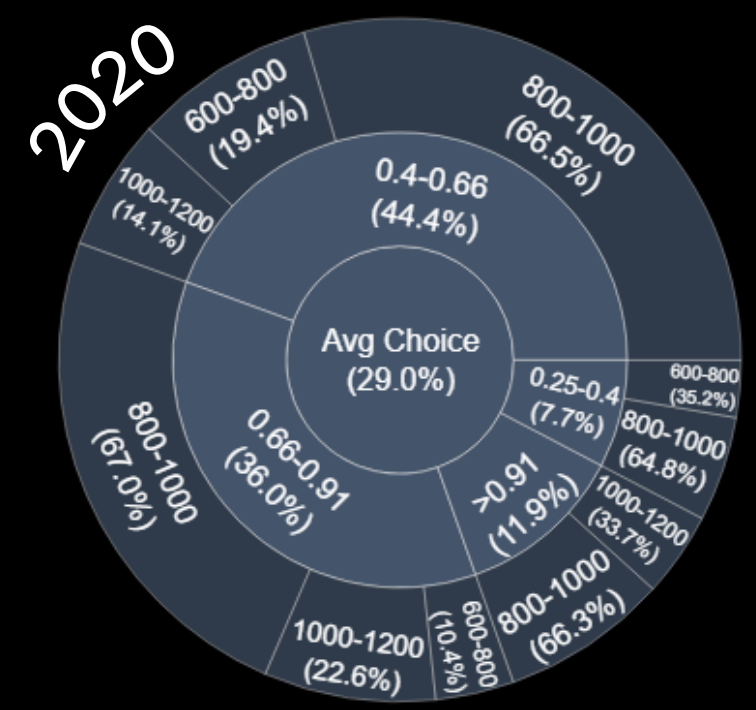
FEEDING QUALITY FORUM

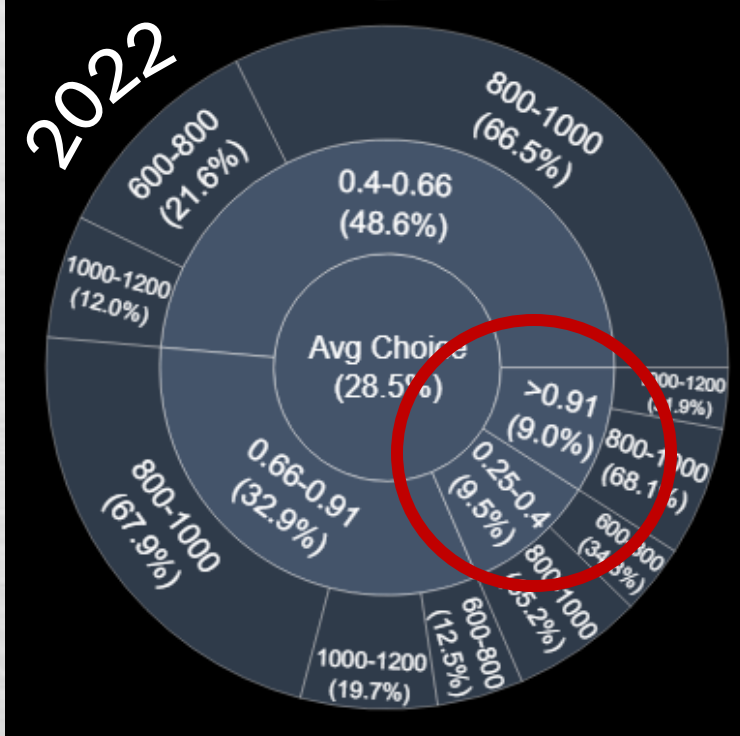
Key Takeaways:

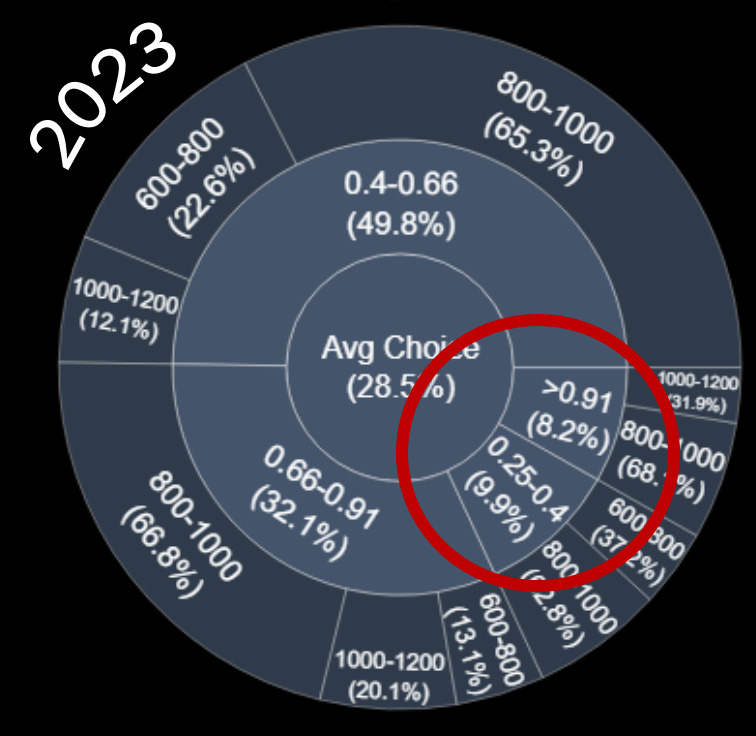
In 2022 and 2023

- Nearly 10% of Modest carcasses had less than 0.4” fat
- 8-9% had fat greater than 0.91”





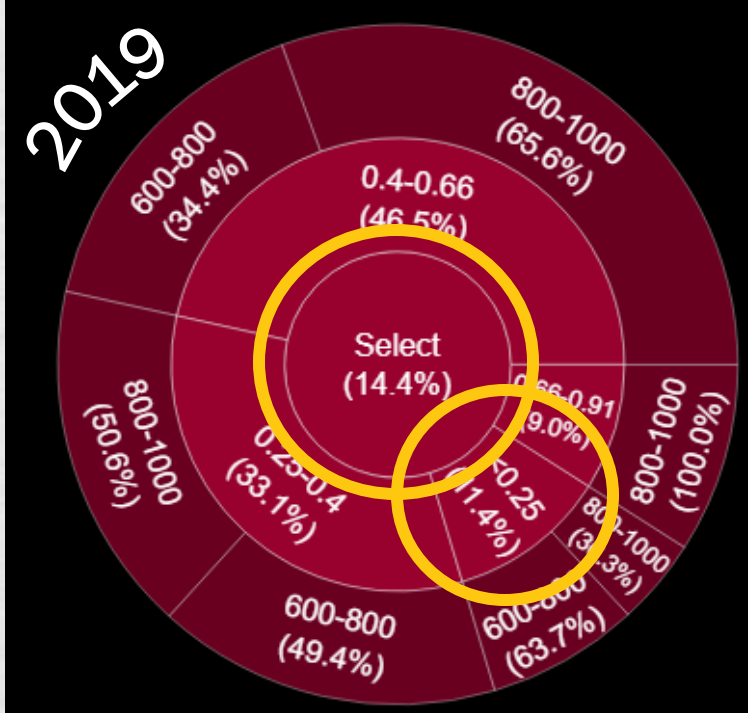


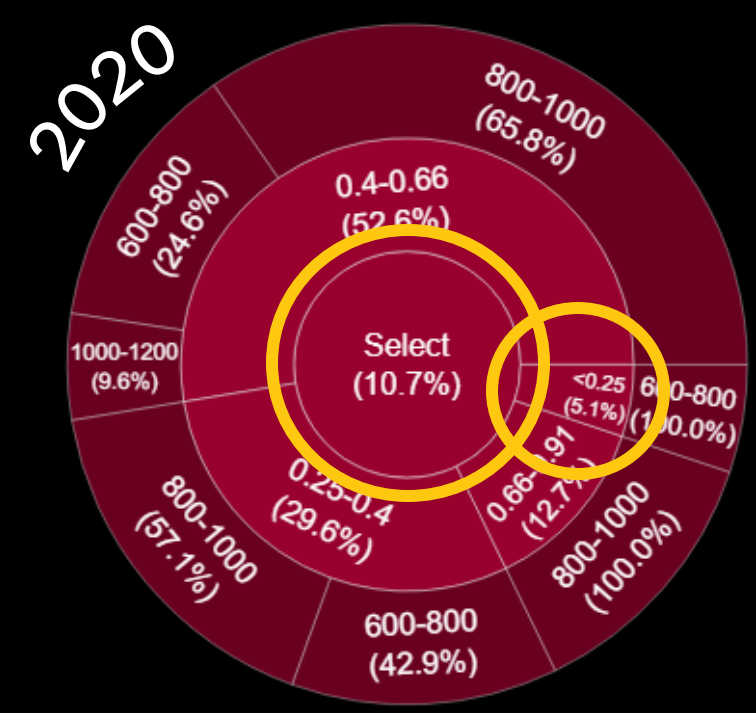


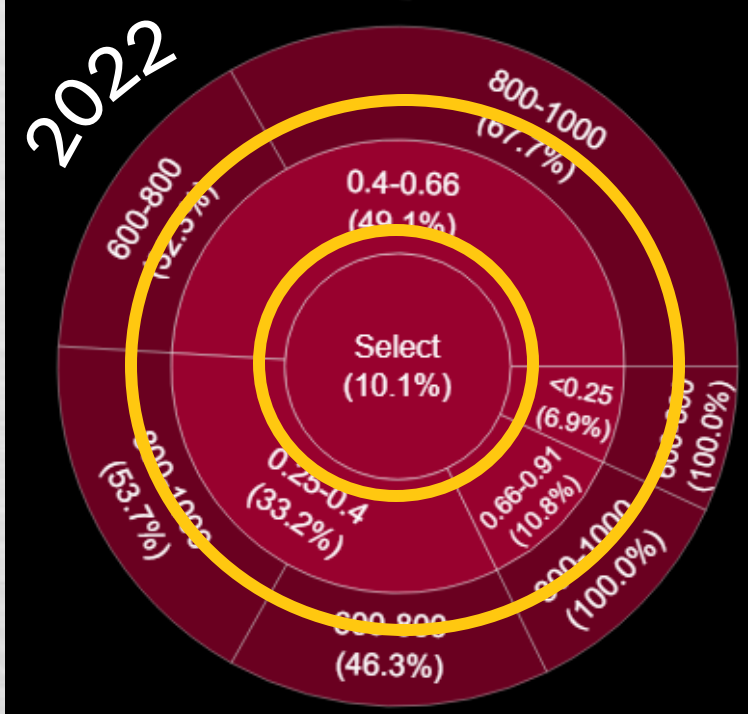
CERTIFIED ANGUS BEEF® BRAND
FEEDING QUALITY FORUM

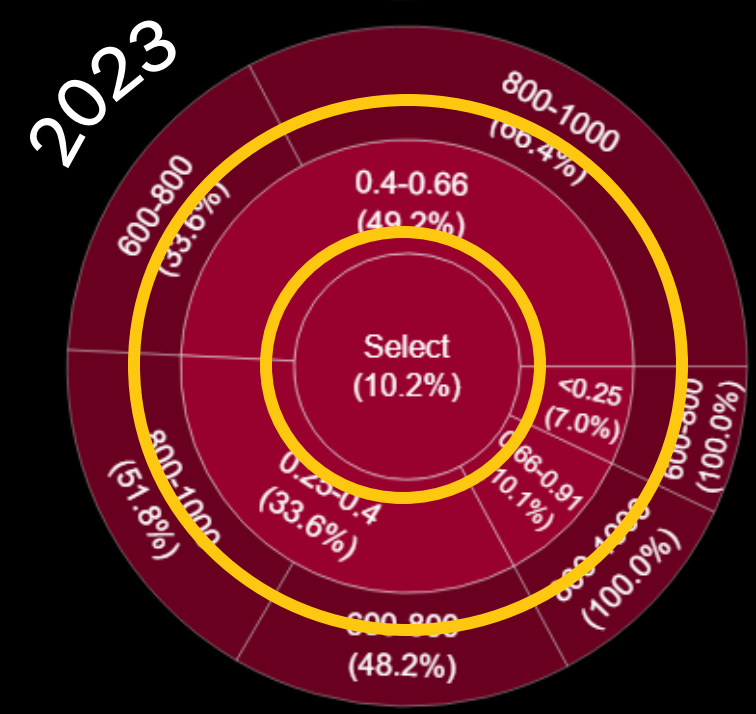
Key Takeaways:

- From 2019 to 2020, Select production decreased by 26%.
  - Significant drop in the number of carcasses with <0.25” fat
- Select production did not change through 2023.
- In 2022 and 2023, over 50% of Select carcasses had 0.4” of fat.







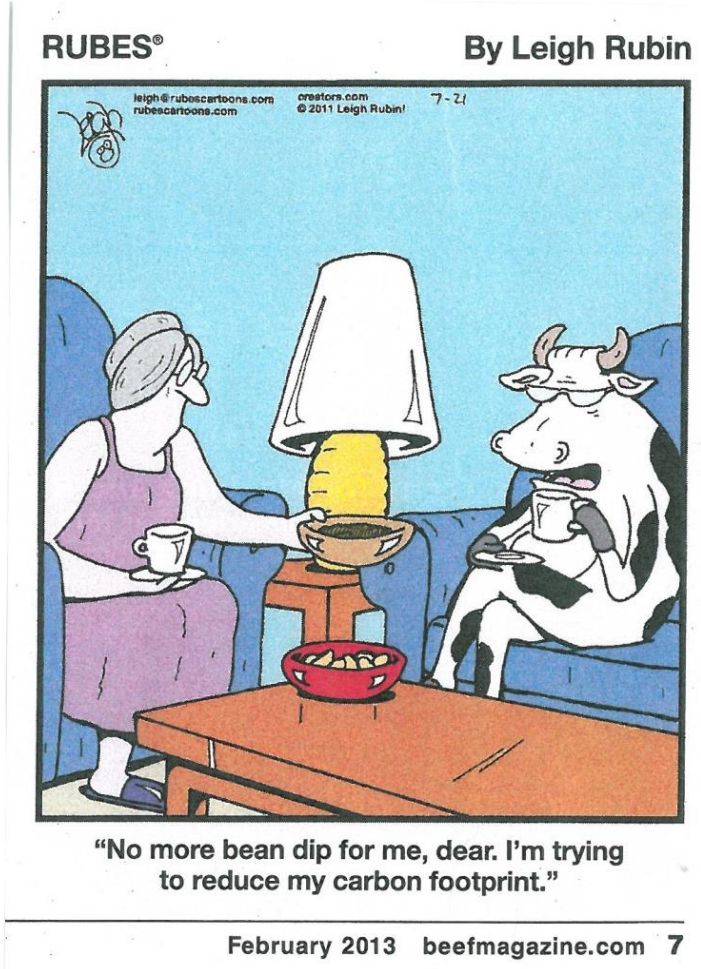


FEEDING QUALITY FORUM

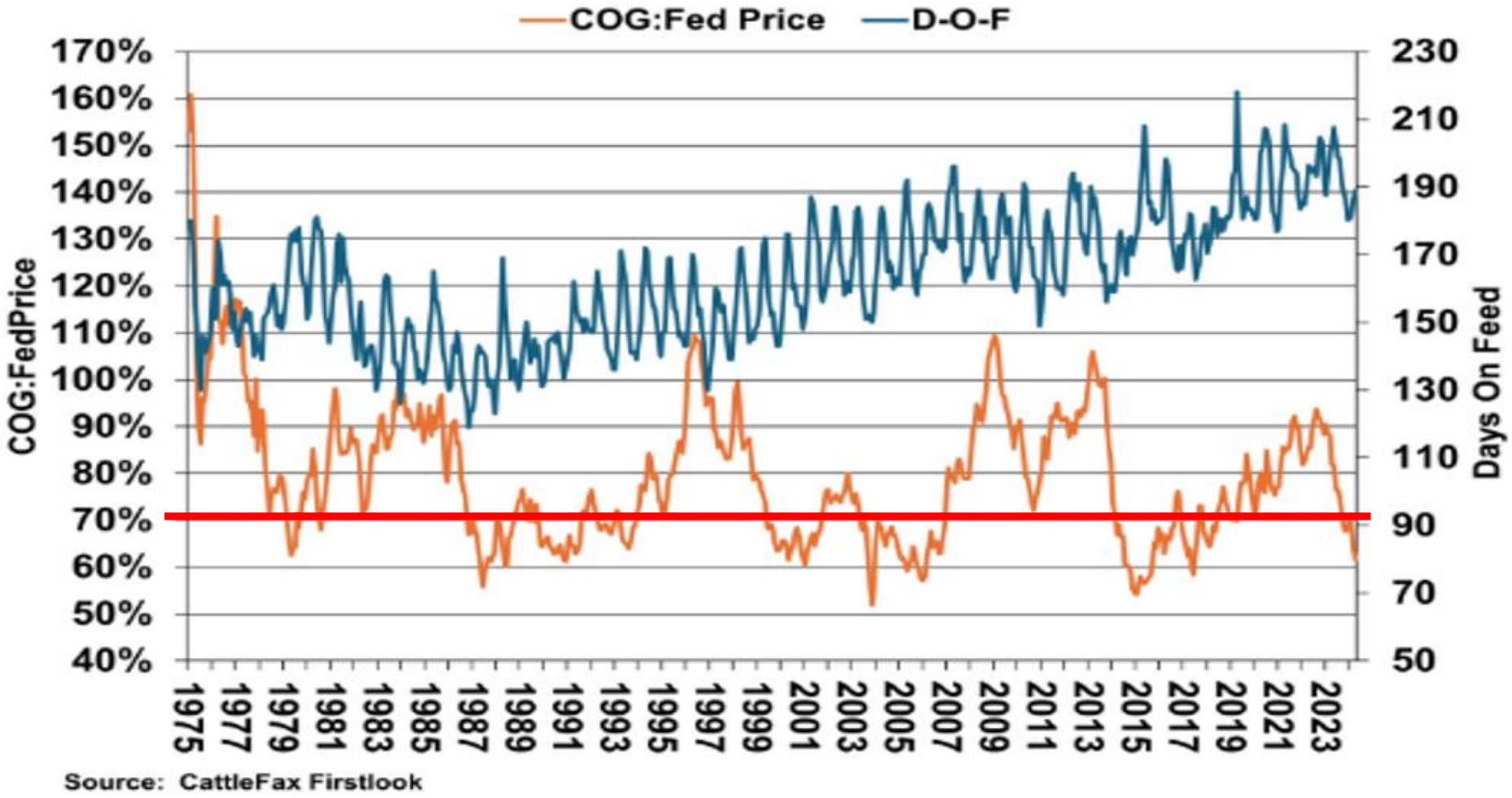
Cost of Fat: Dr. Kristin Hales et al., 2024 TTU BXD Symposium

TEXAS TECH UNIVERSITY
Agricultural Sciences & Natural Resources
Davis College™

- Baseline vs. extended days on feed data
  - Merck serial slaughter studies (Galyean et al., 2023 Appl. Anim. Sci.)
    - 7 steer studies, 6 heifer studies, 2 Holstein steer studies
  - Growth performance
  - Carcass characteristics
- Carbon footprint calculator
  - Present differences in CO_2e

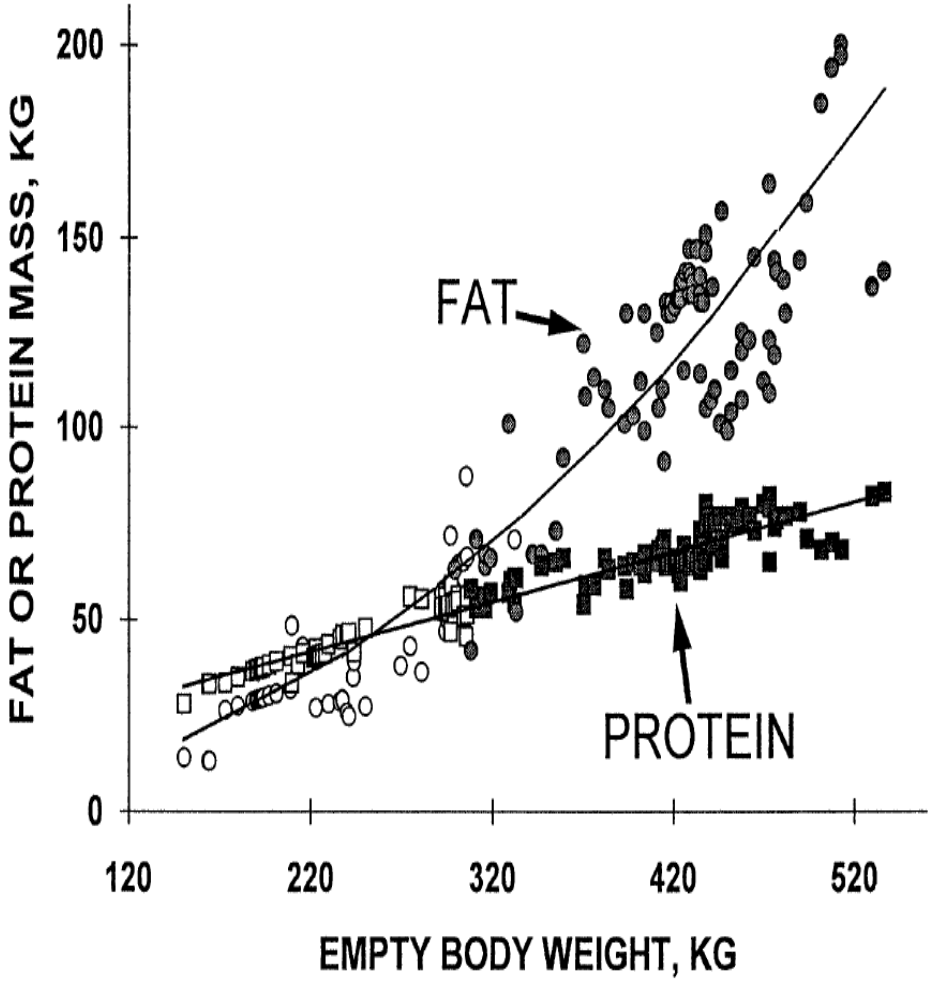


SINCE 1978
CERTIFIED ANGUS BEEF® BRAND
FEEDING QUALITY FORUM



FEEDING QUALITY FORUM

Cost of Fat: Dr. Kristin Hales et al., 2024 TTU BXD Symposium



Growth Definitions

- Metabolizable energy (ME) = energy available to animal for maintenance and gain after feces, urine, and methane energy have been deducted
- Megacalorie (Mcal) = 1,000 kilocalories (1 piece of cheesecake from Cheesecake Factory = 1,000 kilocalories)
- Incremental carcass gain = carcass gain ÷ days
  - 75 to 78% last 30 to 42 days on feed

Cost of Fat: Dr. Kristin Hales et al., 2024 TTU BXD Symposium

Baseline vs. Extended Days on Feed

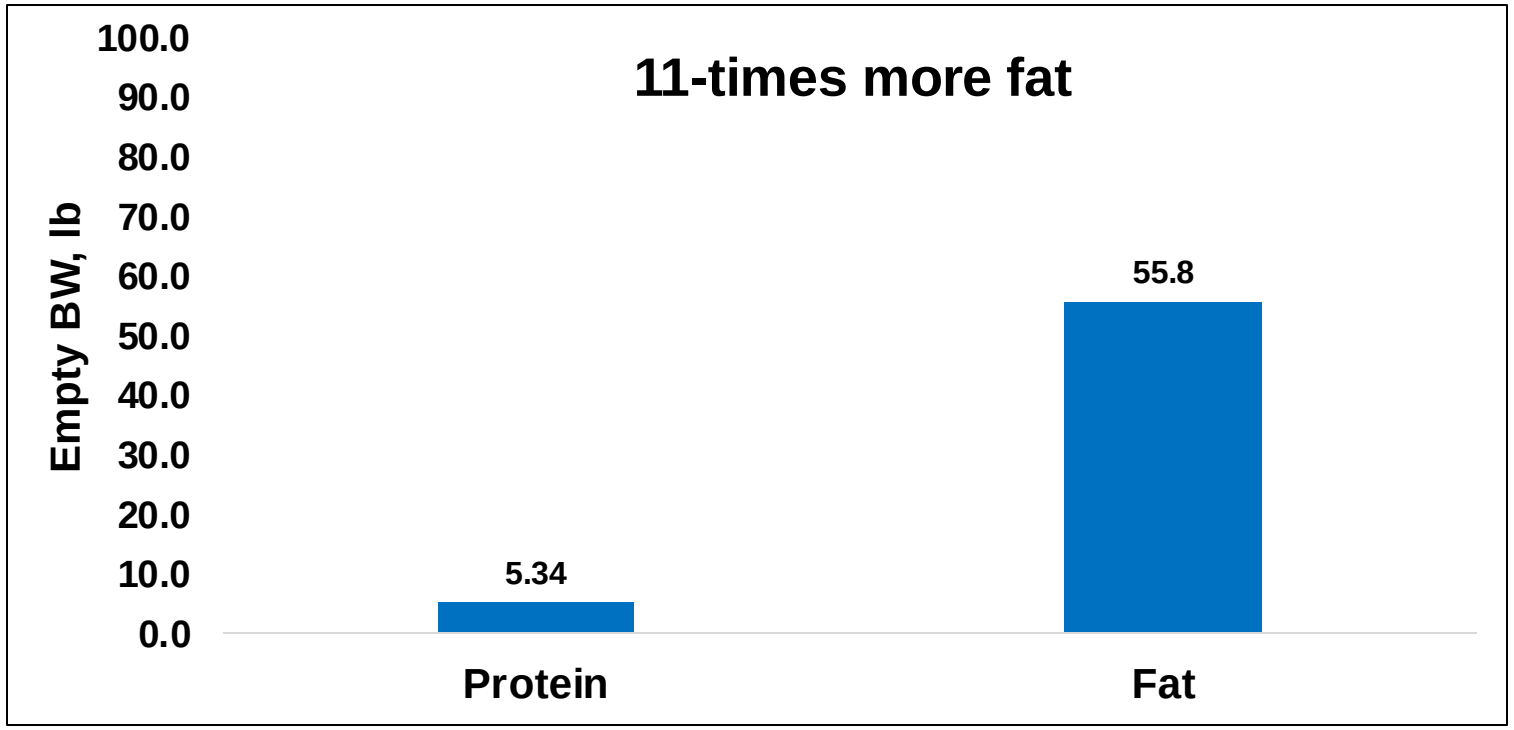
Item	Base		Extended
Days on feed, d	180	+42 days	222
Dry matter intake, lb	21.00	+0.2 lb	21.23
Average daily gain, lb	3.60	-0.2 lb	3.38
Feed:gain	5.83		6.28
Shrunk final BW, lb	1350	+109 lb	1459
Hot carcass weight, lb	864	+85 lb	949
Dressing percent, %	64.00	+ 1 point	65.06
12th ribfat, in.	0.50	+ 0.1 in	0.59
Ribeye area, sq. in.	15.00		15.16
Choice, %	60.00	+12 points	71.71
Calculated yield grade	3.00	+0.5 points	3.52
Yield grade 4 and 5	10.00	+10 points	20.02
Empty body fat, %	28.88	+2 points	30.99

Cost of Fat: Dr. Kristin Hales et al., 2024 TTU BXD Symposium

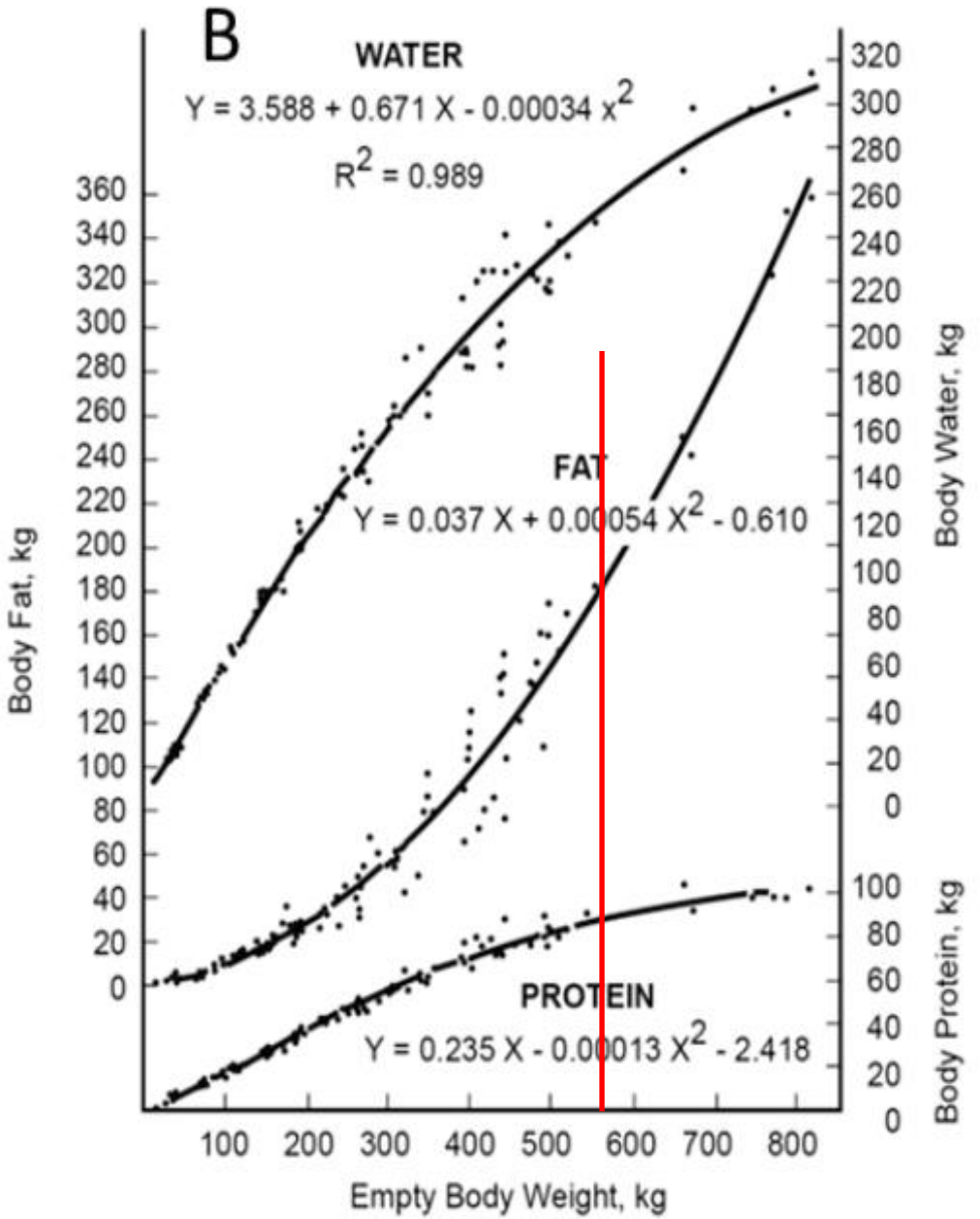
Item	Extended	
Empty body fat gained, lb	55.6	11-times more fat
Empty body protein gained, lb	5.3	
Energy deposited as fat during extended period, Mcal	236.9	

- SFC first 180 days to meet maintenance, fat, protein needs = 2357 lb (42 bu.)
- SFC an additional 42 days to meet maintenance, fat, and protein = 633 lb (11.3 bu.)
- Initial = 13 lb SFC a day vs. Extended = 15 lb SFC a day
- 1 bu. Corn = 4,000 gal of water (precipitation and irrigation combined)
- 11.3 x 4,000 = 45,200 gallons of water

Cost of Fat: Dr. Kristin Hales et al., 2024 TTU BXD Symposium

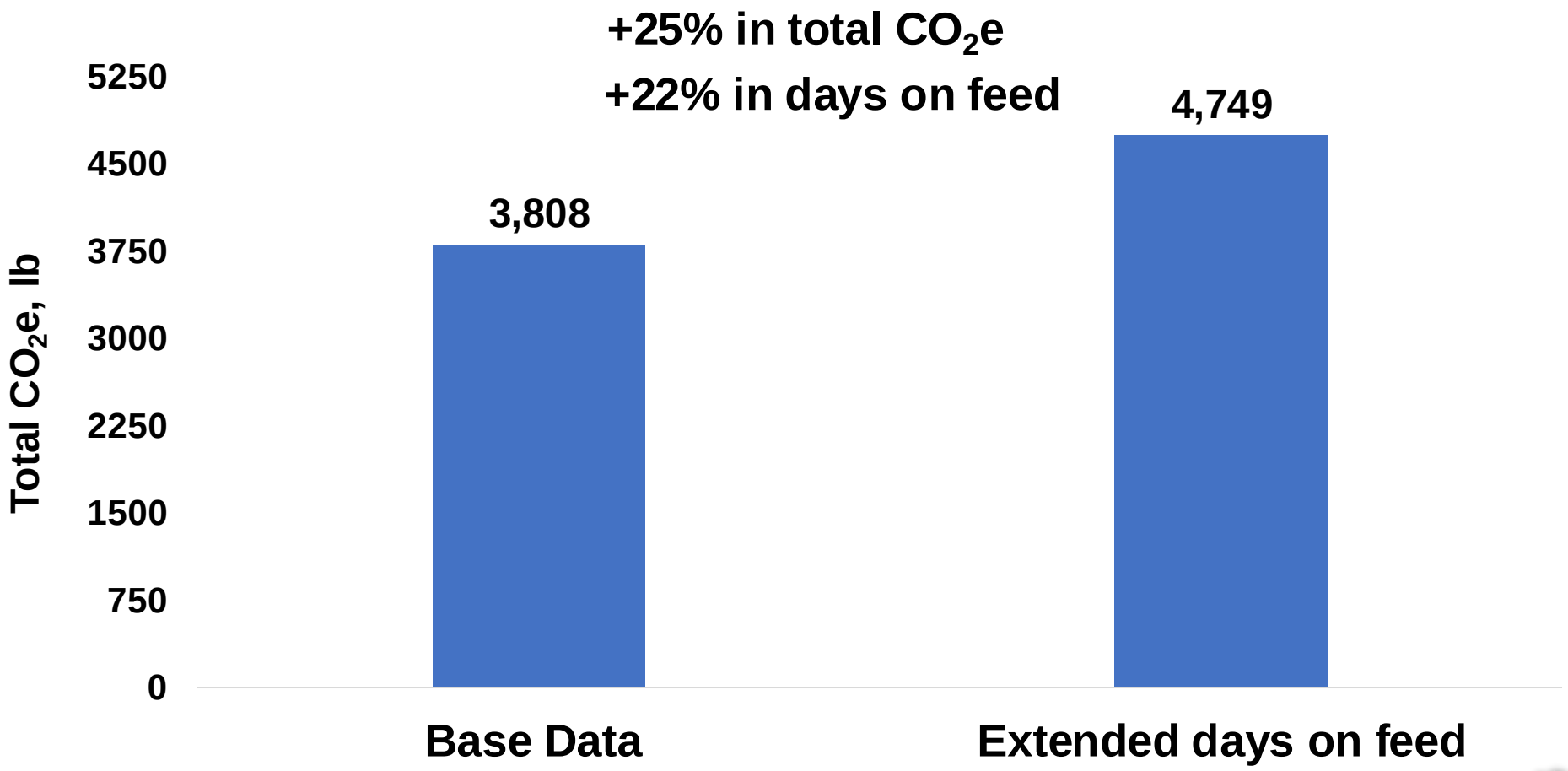


- As EBW increases, accretion rate of fat is greater than the accretion rate for protein
- Fat is stored with greater efficiency
  - 70% efficiency of ME use for fat
  - 25% efficiency of ME use for protein
- More water is stored with deposited protein than deposited fat
  - Protein tissue gain is 4X as efficient as accretion of fat (body weight gain basis)



Cost of Fat: Dr. Kristin Hales et al., 2024 TTU BXD Symposium

Total CO_2e



Cost of Fat: Dr. Kristin Hales et al., 2024 TTU BXD Symposium

Discussion

- How much fatter can we make cattle?
- Owens et al. (1995) stated that at 36% empty body fat and 1645 lb of EBW protein accretion will be 0
  - Cattle will continue to accrete fat
  - 1846 lb of shrunk final body weight
  - 1926 lb of unshrunk final body weight
- 1.9 to 2.1-times more BTU/lb of steam-flaked corn or dry-rolled corn making ethanol vs. biodiesel from tallow
  - Using cattle to produce tallow for biodiesel is not an efficient process
  - Assumes all fat is recovered from carcass which is not possible
    - “Back of envelope” math

Discussion

- What is the **PRIORITY** in reducing waste fat, inefficiency, and carbon, while increasing red meat yield in the U.S. Beef Supply?
  - Increase propensity for marbling at an earlier and leaner endpoint.
  - Reduce days on feed.
  - Increase feed efficiency for marbling.
  - Improve total animal/carcass phenotype/conformation for red meat yield.
  - **MAINTAIN FOCUS ON PRODUCING HIGH QUALITY, GREAT TASTING BEEF!**

FEEDING QUALITY FORUM