

# **PrimeOne**

**An Animal Breeding  
Project That Began With  
The End**

# Historic Animal Breeding



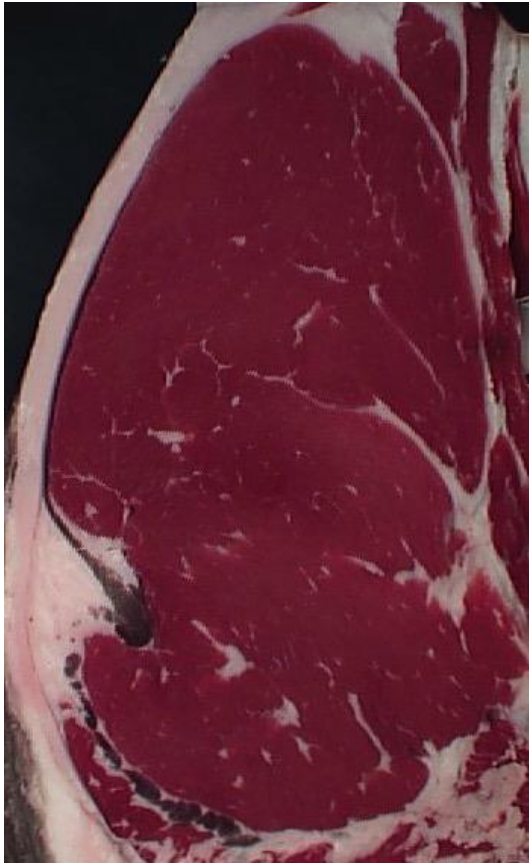
X



=



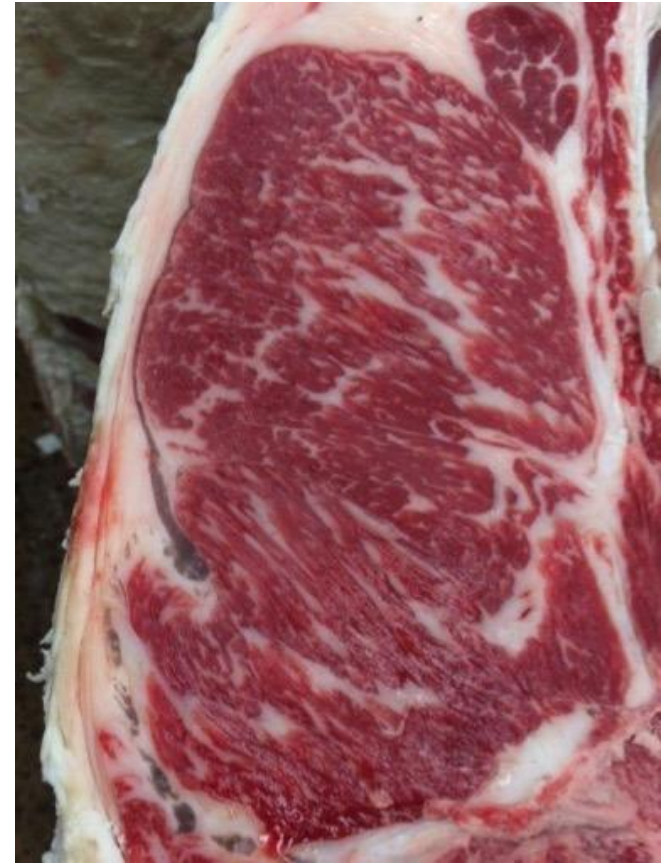
# Meathead Animal Breeding



X

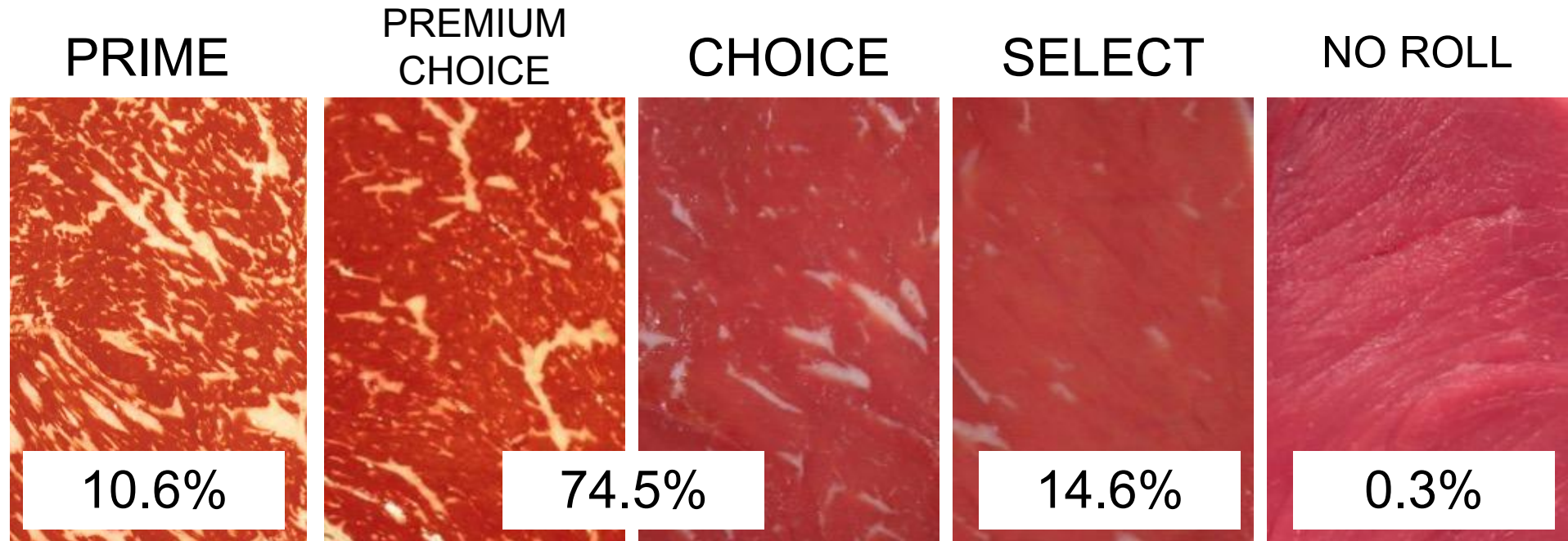


=





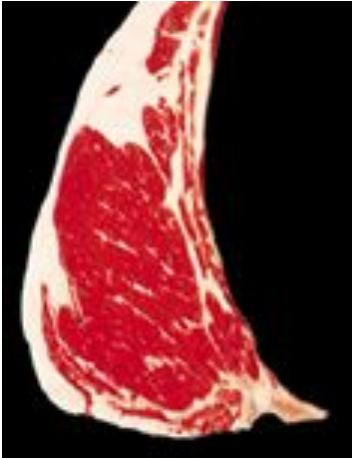
# Quality Grading Outcomes - 2021



# Yield Grading Outcomes - 2021

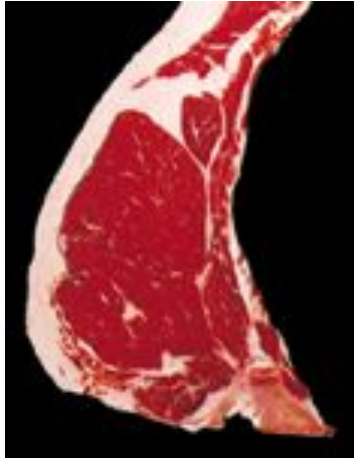
3.6%

YG  
1



29.6%

YG  
2



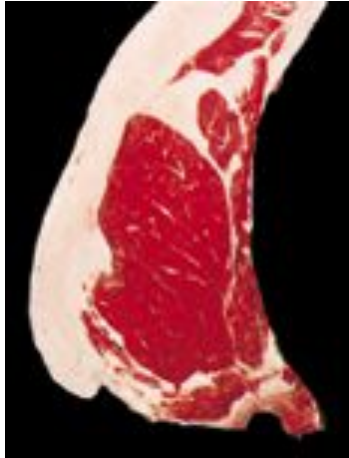
50.6%

YG  
3



13.6%

YG  
4



2.6%

YG  
5



# 2021 – QG x YG Distribution

	Prime	Choice	Select	Standard
YG 1	0.05	1.50	1.83	0.00
YG 2	1.18	20.5	7.9	0.00
YG 3	5.9	39.7	5.3	0.01
YG 4	2.43	10.5	0.72	0.00
YG 5	0.69	1.82	0.10	0.00

# 2021 – QG x YG Distribution

	Prime	Choice	Select	Standard
YG 1	2,952			
YG 2				
YG 3				
YG 4				
YG 5				6

The Problem...

**QUALITY**

**AND**

**YIELD**

**ARE**

**ANTAGONISTS**



Our Hypothesis:

**CROSSBREEDING**

**PRIMEONE**

**ANIMALS WILL IMPROVE**

**QUALITY AND YIELD**

# Phenotypic Tissue Selection

- 45 carcasses selected
- 44% steers
- Hot carcass weight =  $814.3 \pm 13.2$  lbs.
- Marbling =  $811 \pm 16$
- 12<sup>th</sup> rib s.c. fat depth =  $0.33 \pm 0.02$  in.
- Longissimus muscle area =  $16.1 \pm 0.3$  in<sup>2</sup>
- Calculated yield grade =  $1.69 \pm 0.1$



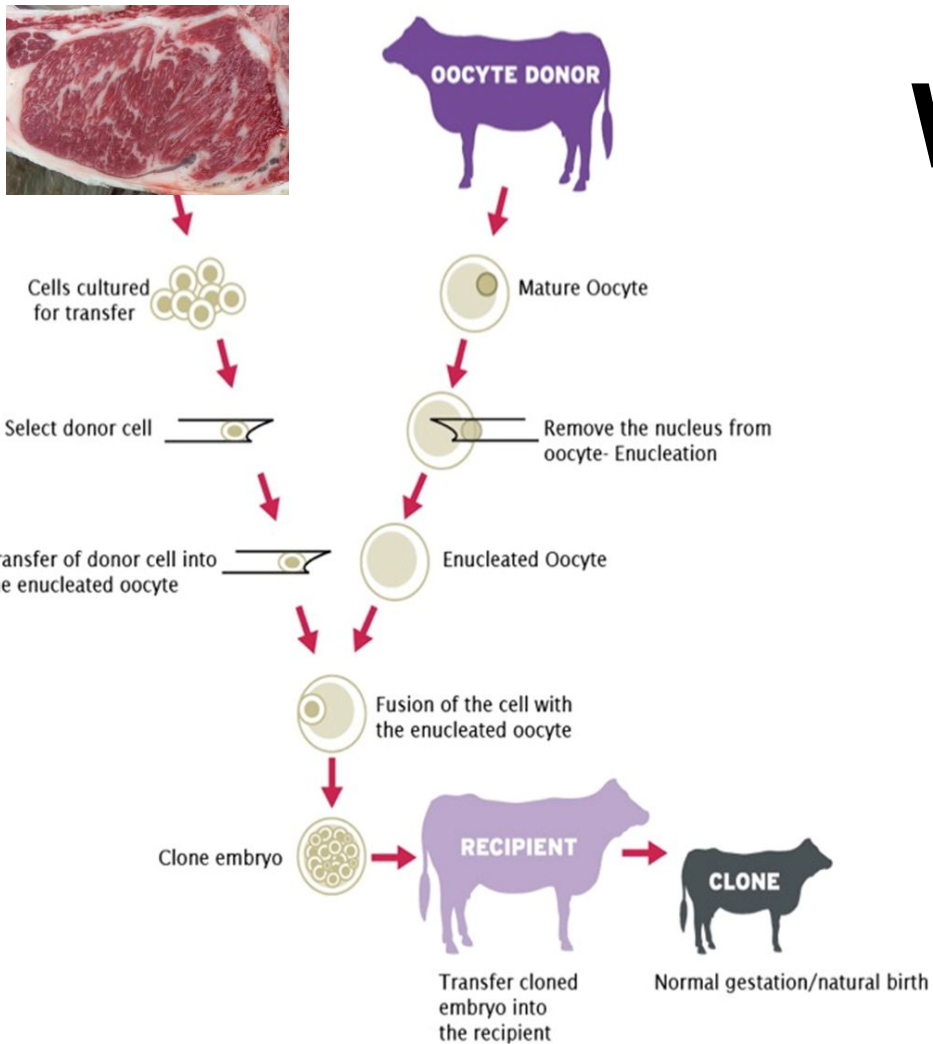
# Genotypic Refinement

- Clone candidates were evaluated and selected based upon genetic markers for growth, quality, yield and palatability traits.

- **Phenotype**
  - **Prime-YG1**
    - **1 per 2,000**
- **Genotype**
  - **Refine**
    - **1 per 22,500**

- Percentile rankings
  - Weaning weight = 60<sup>th</sup> ± 3
  - Dry matter intake = 38<sup>th</sup> ± 3
  - Feed efficiency = 33<sup>rd</sup> ± 4
  - Carcass weight = 60<sup>th</sup> ± 4
  - Backfat = 43<sup>rd</sup> ± 3
  - Ribeye area = 61<sup>st</sup> ± 3
  - Marbling score = 48<sup>th</sup> ± 4
  - Tenderness = 67<sup>th</sup> ± 4

# Somatic Cell Nuclear Transfer



## What is a Clone?

- An animal that is genetically identical to its donor, having developed from a single donated cell
- An identical twin from different points in time

# Clones - Alpha

<u>PHENOTYPIC</u>	
Sex	Steer
Hot carcass weight	783 lbs
Marbling:	Slab <sup>70</sup>
12 <sup>th</sup> rib s.c. fat	0.44 in
Longissimus muscle area	15.9 in <sup>2</sup>
Calculated yield grade	1.98
Hide	51% Blk

<u>GENOTYPIC</u>	
Color:	EDED (Homozygous black)
Weaning weight:	30 <sup>th</sup> percentile
Dry matter intake:	30 <sup>th</sup> percentile
Feed efficiency:	10 <sup>th</sup> percentile
Carcass weight:	30 <sup>th</sup> percentile
Backfat:	15 <sup>th</sup> percentile
Ribeye area:	70 <sup>th</sup> percentile
Marbling:	30 <sup>th</sup> percentile
Tenderness:	6 <sup>th</sup> percentile

# Clones - Alpha

PHENOTYPIC	
Sex	Steer
Hot carcass weight	783 lbs
Marbling:	Slab <sup>70</sup>
12 <sup>th</sup> rib s.c. fat	0.44 in
Longissimus muscle area	15.9 in <sup>2</sup>
Calculated yield grade	1.98
Hide	51% Blk



GENOTYPIC	
Color:	EDED (Homozygous black)
Weaning weight:	30 <sup>th</sup> percentile
Dry matter intake:	30 <sup>th</sup> percentile
Feed efficiency:	10 <sup>th</sup> percentile
Carcass weight:	30 <sup>th</sup> percentile
Backfat:	15 <sup>th</sup> percentile
Ribeye area:	70 <sup>th</sup> percentile
Marbling:	30 <sup>th</sup> percentile
Tenderness:	6 <sup>th</sup> percentile



# Clones - Gamma

<u>PHENOTYPIC</u>	
Sex	Heifer
Hot carcass weight	708 lbs
Marbling:	Slab <sup>10</sup>
12 <sup>th</sup> rib s.c. fat	0.16 in
Longissimus muscle area	15.5 in <sup>2</sup>
Calculated yield grade	1.03
Hide	51% Blk

<u>GENOTYPIC</u>	
Color:	EDED (Homozygous black)
Weaning weight:	90 <sup>th</sup> percentile
Dry matter intake:	10 <sup>th</sup> percentile
Feed efficiency:	10 <sup>th</sup> percentile
Carcass weight:	50 <sup>th</sup> percentile
Backfat:	50 <sup>th</sup> percentile
Ribeye area:	50 <sup>th</sup> percentile
Marbling:	5 <sup>th</sup> percentile
Tenderness:	30 <sup>th</sup> percentile

# Clones - Gamma

PHENOTYPIC	
Sex	Heifer
Hot carcass weight	708 lbs
Marbling:	Slab <sup>10</sup>
12 <sup>th</sup> rib s.c. fat	0.16 in
Longissimus muscle area	15.5 in <sup>2</sup>
Calculated yield grade	1.03
Hide	51% Blk



GENOTYPIC	
Color:	EDED (Homozygous black)
Weaning weight:	90 <sup>th</sup> percentile
Dry matter intake:	10 <sup>th</sup> percentile
Feed efficiency:	10 <sup>th</sup> percentile
Carcass weight:	50 <sup>th</sup> percentile
Backfat:	50 <sup>th</sup> percentile
Ribeye area:	50 <sup>th</sup> percentile
Marbling:	5 <sup>th</sup> percentile
Tenderness:	30 <sup>th</sup> percentile

# Clones - Gamma

PHENOTYPIC	
Sex	Heifer
Hot carcass weight	708 lbs
Marbling:	Slab <sup>10</sup>
12 <sup>th</sup> rib s.c. fat	0.16 in
Longissimus muscle area	15.5 in <sup>2</sup>
Calculated yield grade	1.03
Hide	51% Blk



GENOTYPIC	
Color:	EDED (Homozygous black)
Weaning weight:	90 <sup>th</sup> percentile
Dry matter intake:	10 <sup>th</sup> percentile
Feed efficiency:	10 <sup>th</sup> percentile
Carcass weight:	50 <sup>th</sup> percentile
Backfat:	50 <sup>th</sup> percentile
Ribeye area:	50 <sup>th</sup> percentile
Marbling:	5 <sup>th</sup> percentile
Tenderness:	30 <sup>th</sup> percentile

# Experiment 1 – Alpha x Gamma<sup>123</sup>



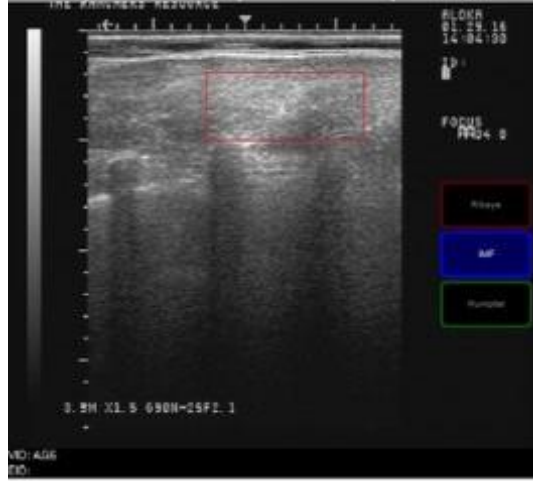




# Alpha x Gamma calves

**9 bulls**  
(7 steers)  
**4 heifers**

# Alpha x Gamma finished steers



DOF	Body weight, lbs	Backfat, in	Ribeye area, cm <sup>2</sup>	Intramuscular fat	Prime
77	915	0.34	12.0	8.2%	3/7
137	1,096	0.42	12.9	8.7%	4/7
180	1,222	0.50	14.1	8.9%	5/7



# Alpha x Gamma carcass outcomes

- Quality Grade
  - 1 Prime
  - 3 High Choice
  - 3 Mid Choice
    - Moderate<sup>30</sup>
- Yield Grade
  - 1 YG<sub>1</sub>
  - 6 YG<sub>2</sub>
    - 765 lb HCW
    - 0.43 in FAT
    - 15.0 in<sup>2</sup> REA
    - 2.13 YG



# Experiment 2 – Terminal Sire Comparison

- 1274 cows
  - Cows random entry
  - 10 straws thawed per sire
    - Cycle repeated



# Experiment 2 - Outcomes

Outcome	Alpha	Angus	Charolais	Simmental	SEM	
n	83	108	124	108	--	--
Feedlot arrival weight, lbs	633 <sup>ab</sup>	615 <sup>b</sup>	633 <sup>ab</sup>	<b>642<sup>a</sup></b>	44.1	0.03
Hot carcass weight, lbs	864	<b>886</b>	871	880	59.5	0.07
12 <sup>th</sup> rib s.c. fat, in	0.59 <sup>b</sup>	<b>0.76<sup>a</sup></b>	0.43 <sup>c</sup>	0.62 <sup>b</sup>	0.02	<0.01
Longissimus muscle area, in <sup>2</sup>	14.9 <sup>b</sup>	14.0 <sup>c</sup>	<b>15.7<sup>a</sup></b>	14.7 <sup>b</sup>	0.19	<0.01
Calculated yield grade	2.99 <sup>c</sup>	<b>3.74<sup>a</sup></b>	2.42 <sup>d</sup>	3.20 <sup>b</sup>	0.24	<0.01
Marbling score	Modest <sup>06 b</sup>	<b>Modest<sup>86 a</sup></b>	Small <sup>35 c</sup>	Small <sup>90 b</sup>	10	<0.01
Empty body fat, %	30.9 <sup>b</sup>	<b>34.1<sup>a</sup></b>	28.2 <sup>c</sup>	31.4 <sup>b</sup>	0.68	<0.01
Carcass value/cwt, \$	<b>203.67<sup>a</sup></b>	<b>203.45<sup>a</sup></b>	200.45 <sup>b</sup>	202.40 <sup>ab</sup>	2.47	0.03
Total carcass value, \$	<b>1772.14</b>	<b>1781.65</b>	<b>1784.44</b>	<b>1791.40</b>	106	0.85

# Experiment 2 - Outcomes

Outcome	Alpha	Angus	Charolais	Simmental	
n	83	108	124	108	--
Quality Grade					
Prime, %	2.41 <sup>b</sup>	<b>20.37<sup>a</sup></b>	0 <sup>b</sup>	0 <sup>b</sup>	0.03
CAB, %	37.4 <sup>a</sup>	<b>43.5<sup>a</sup></b>	0.81 <sup>b</sup>	41.7 <sup>a</sup>	<0.01
Commodity Choice, %	54.2 <sup>b</sup>	31.5 <sup>c</sup>	<b>76.6<sup>a</sup></b>	50.9 <sup>b</sup>	<0.01
Select, %	6.0 <sup>b</sup>	4.63 <sup>b</sup>	<b>22.6<sup>a</sup></b>	7.41 <sup>b</sup>	<0.01
Yield Grade					
1, %	2.41 <sup>b</sup>	0.93 <sup>b</sup>	<b>36.3<sup>a</sup></b>	6.48 <sup>b</sup>	<0.01
2, %	<b>54.2<sup>a</sup></b>	17.6 <sup>b</sup>	50.8 <sup>a</sup>	42.6 <sup>a</sup>	<0.01
3, %	41.0 <sup>a</sup>	<b>46.3<sup>a</sup></b>	12.1 <sup>b</sup>	38.9 <sup>a</sup>	<0.01
4, %	2.41 <sup>b</sup>	<b>32.4<sup>a</sup></b>	0 <sup>c</sup>	12.0 <sup>b</sup>	<0.01
5, %	<b>0</b>	<b>0</b>	<b>2.78</b>	<b>0</b>	1.00



# Experiment 3 – Terminal Sire Comparison

- 991 cows
  - Cows random entry
  - 10 straws thawed per sire
    - Cycle repeated



# Experiment 3 - Outcomes

Outcome	Alpha		Angus	Simmental	SimAngus	SE	M
n	79	102	73	91	45	--	--
Feedlot arrival weight, lbs	<b>684</b>	<b>686</b>	<b>695</b>	<b>688</b>	<b>681</b>	30.9	0.64
Hot carcass weight, lbs	847 <sup>c</sup>	860 <sup>bc</sup>	<b>895<sup>a</sup></b>	862 <sup>bc</sup>	<b>880<sup>ab</sup></b>	30.9	<0.01
12 <sup>th</sup> rib s.c. fat, in	<b>0.64</b>	<b>0.61</b>	<b>0.66</b>	<b>0.63</b>	<b>0.65</b>	0.03	0.16
Longissimus muscle area, in <sup>2</sup>	14.1 <sup>bc</sup>	<b>14.5<sup>a</sup></b>	<b>14.4<sup>ab</sup></b>	<b>14.4<sup>ab</sup></b>	13.9 <sup>c</sup>	0.16	<0.01
Calculated yield grade	3.30 <sup>bc</sup>	3.15 <sup>c</sup>	<b>3.45<sup>ab</sup></b>	3.23 <sup>c</sup>	<b>3.53<sup>a</sup></b>	0.16	<0.01
Marbling score	Modest <sup>61</sup> b	<b>Moderate<sup>11</sup></b> a	Modest <sup>48</sup> bc	Modest <sup>34</sup> c	Modest <sup>29</sup> c	18	<0.01
Empty body fat, %	<b>32.1</b>	<b>32.1</b>	<b>32.5</b>	<b>31.7</b>	<b>32.4</b>	0.6	0.25
Carcass value/cwt, \$	191.99 <sup>b</sup>	<b>194.22<sup>a</sup></b>	187.55 <sup>c</sup>	191.59 <sup>b</sup>	186.63 <sup>c</sup>	1.5	<0.01
Total carcass value, \$	1622.56 <sup>c</sup>	<b>1667.28<sup>ab</sup></b>	<b>1674.61<sup>a</sup></b>	<b>1647.81<sup>ab</sup></b> c	1635.14 <sup>bc</sup>	47	0.01



# Experiment 3 - Outcomes

Outcome	Alpha		Angus	Simmental	SimAngus	
n	79	102	73	91	45	--
Quality Grade						
Prime, %	11.4 <sup>b</sup>	<b>23.5<sup>a</sup></b>	4.11 <sup>bc</sup>	2.20 <sup>c</sup>	4.44 <sup>bc</sup>	<0.01
CAB, %	<b>54.4</b>	<b>53.9</b>	<b>42.5</b>	<b>53.9</b>	<b>37.8</b>	0.22
Commodity Choice, %	34.2 <sup>ab</sup>	21.6 <sup>b</sup>	<b>46.6<sup>a</sup></b>	42.9 <sup>a</sup>	48.9 <sup>a</sup>	<0.01
Select, %	<b>0</b>	<b>0.98</b>	<b>6.85</b>	<b>1.10</b>	<b>8.89</b>	0.16
Yield Grade						
1, %	<b>1.27</b>	<b>6.86</b>	<b>2.74</b>	<b>2.20</b>	<b>4.44</b>	0.36
2, %	<b>36.7</b>	<b>30.4</b>	<b>23.3</b>	<b>33.0</b>	<b>15.6</b>	0.12
3, %	<b>44.3</b>	<b>53.9</b>	<b>52.1</b>	<b>50.6</b>	<b>51.1</b>	0.78
4, %	16.5	8.82	20.6	14.3	<b>28.9</b>	0.06
5, %	<b>1.27</b>	<b>0</b>	<b>1.37</b>	<b>0</b>	<b>0</b>	1.00

# Experiment 4 – Terminal Sire Comparison

- 2000 Jersey cows
  - Semen tank changed every other cow
  - Calves born Dec 2020 – March 2021
  - Currently finishing in Nebraska



# Experiment 4 – Outcomes thus far

Outcome			SE	
			M	
<i>n</i> services	984	946	--	--
Conception rate, %	<b>39.4</b>	30.5	--	<0.01
Gestation length, d	<b>284</b>	280	0.31	<0.01
<i>n</i> calves	318	221	--	--
Birth weight, lbs	<b>77.2</b>	71.9	0.6	<0.01
Calving ease score	1.04	1.02	--	0.24
120 d body weight, lbs	238.2	238.4	3.6	0.97
Average daily gain, lbs	1.48	1.54	0.02	0.09
Morbidity, %	86.1	89.7	--	0.25
Culled, %	2.52	0.91	--	0.17
Mortality, %	1.89	0.45	--	0.15
<i>n</i> calves	297	207	--	--
Feedlot in-weight	835	<b>880</b>	11.8	<0.01

# Our Goals

- Develop genetic opportunities to improve beef quality and yield
- Improve beef production efficiency
- Highlight the role of technology in agriculture
- Provide unique learning opportunities for students



# Acknowledgements

- Viagen
- Dr. Gregg Veneklasen & Mr. Jason Abraham
- WTAMU Faculty
  - Dr. Dean Hawkins, Dr. David Lust, Dr. Trent McEvers, Dr. Tommy Perkins, Dr. Travis Tennant
- WTAMU Graduate Students
  - Jessica Sperber
  - Forest Francis
  - Landon Canterbury
  - Katy Jo Richardson
  - Kara Belt

