West Texas A&M University™

WT Agriculture™

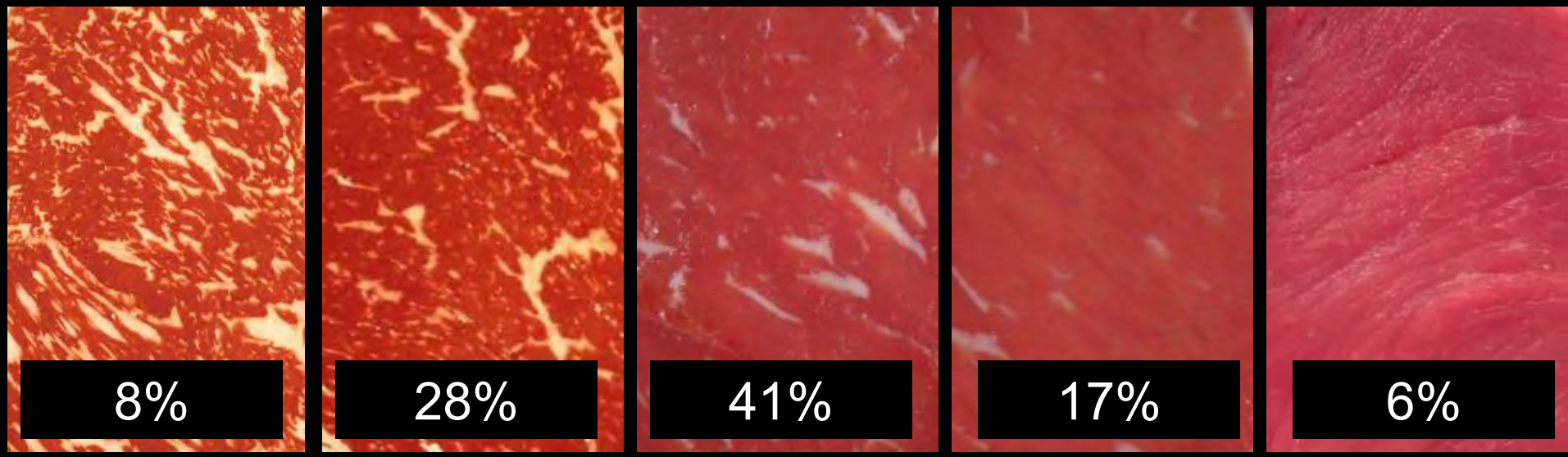
PrimeOne

PrimeOne:
A Public/Private Partnership

- WTAMU
  - Beef Carcass Research Center
  - Nance Ranch
  - Research Feedlot
- Timber Creek Veterinary Clinic
- Mendota Ranch
- Viagen and TransOva
- Cactus Feeders

Quality Grading

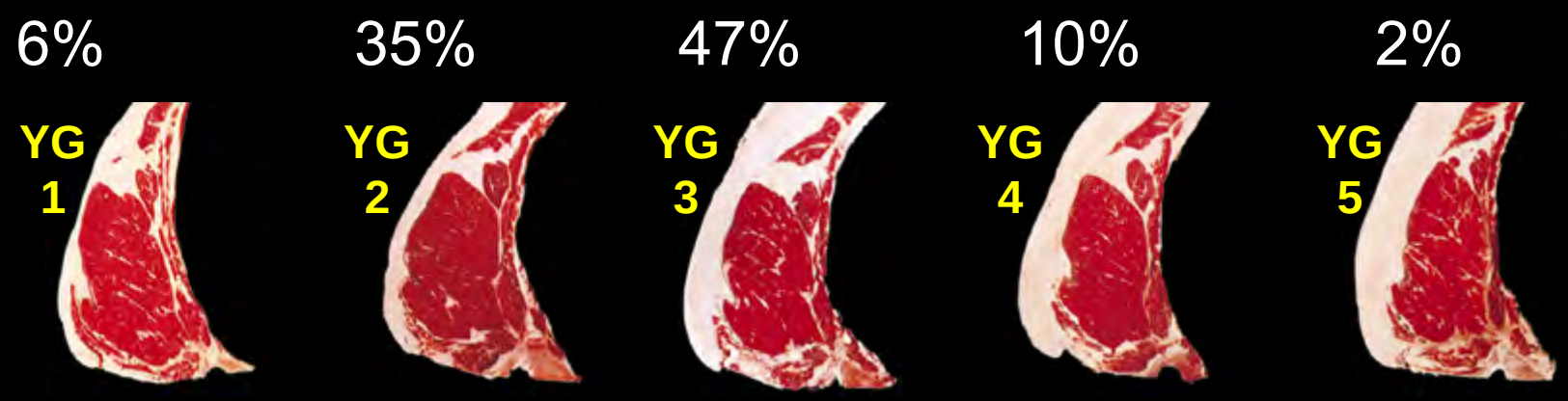
- **Marbling**
  - **subjective evaluation of the quantity of intramuscular fat in the *longissimus* muscle between the 12th and 13th ribs**



- **Maturity**
  - **Number of permanent incisors present at harvest**
  - **Subjective evaluation of the extent of ossification (conversion of cartilage to bone) of the vertebral column**

Yield Grading

- **Fat Thickness**
  - **Linear measure of backfat**
- **Rib eye Area**
  - **Cross-section area of *longissimus* muscle**
- **Hot Carcass Weight**
  - **Weight of the freshly dressed carcass immediately prior to chilling**
- **Estimated % of Kidney Pelvic and Heart Fat**
  - **Subjective evaluation of weight of internal fat in relation to carcass weight**



Distribution matrix of USDA QG x YG

Cumulative = 100%

	Prime	Choice	Select	Standard	Commercial	Utility
YG 1	0.06	2.46	2.89	0.00	0.00	0.00
YG 2	1.45	24.18	9.10	0.00	0.01	0.13
YG 3	5.33	36.82	5.02	0.00	0.05	0.34
YG 4	1.76	7.81	0.55	0.00	0.04	0.14
YG 5	0.48	1.24	0.08	0.00	0.01	0.03

The Problem:

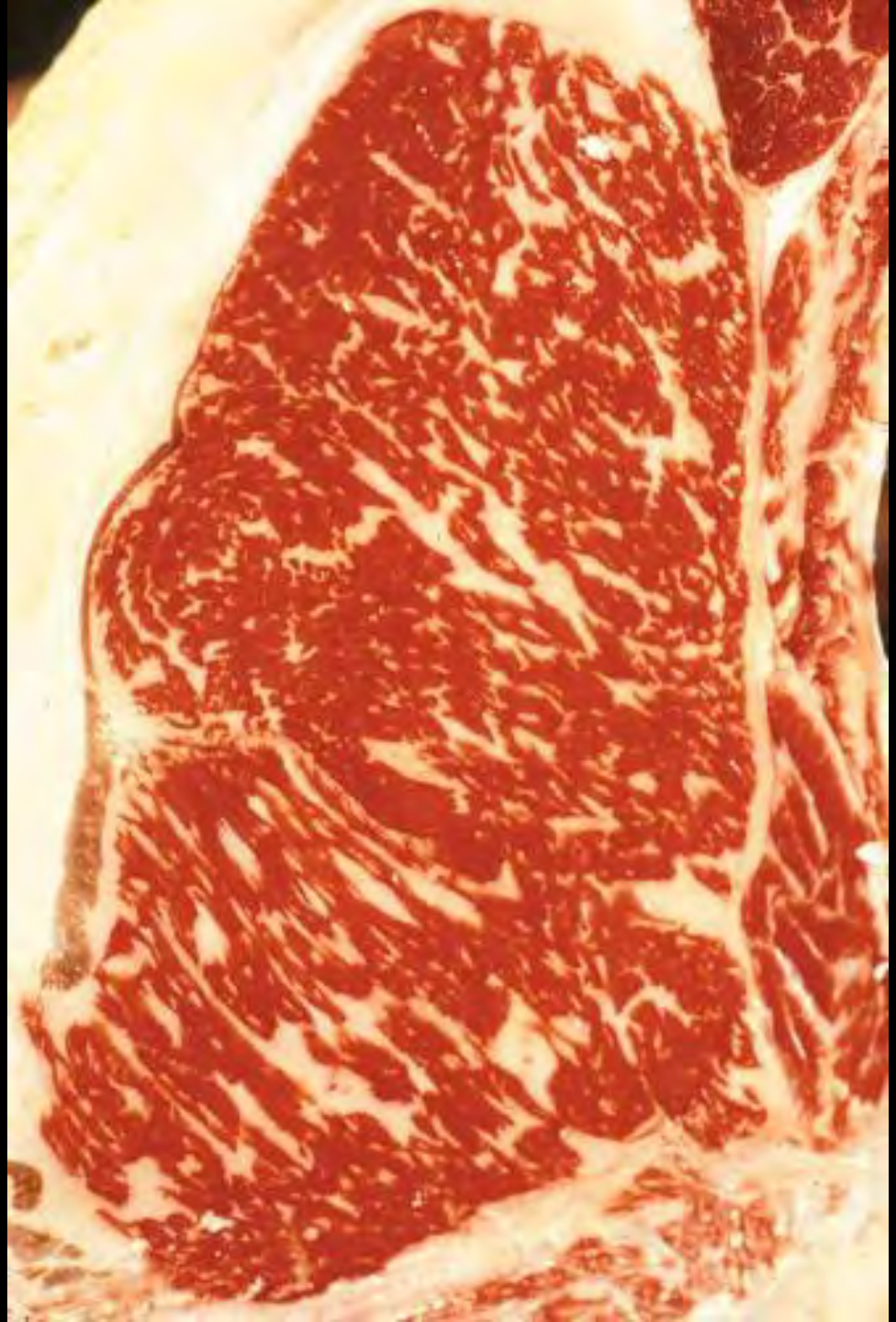
QUALITY

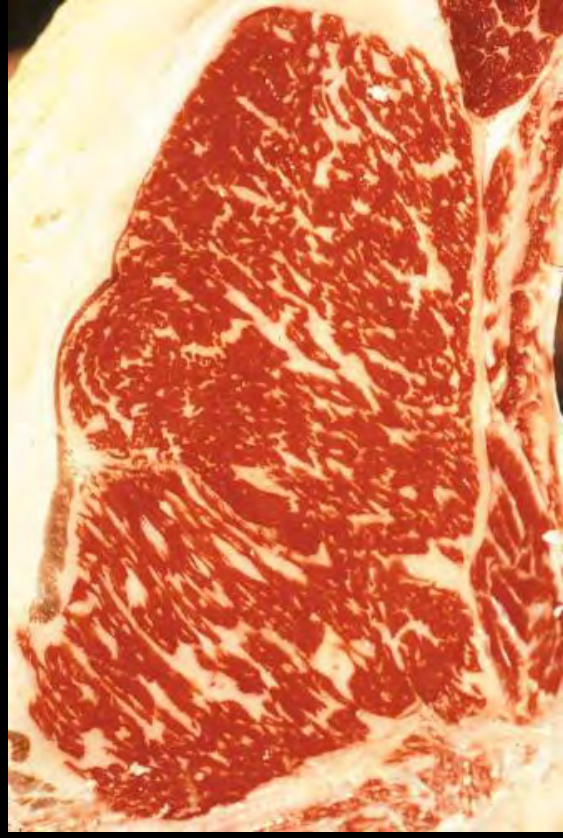
AND

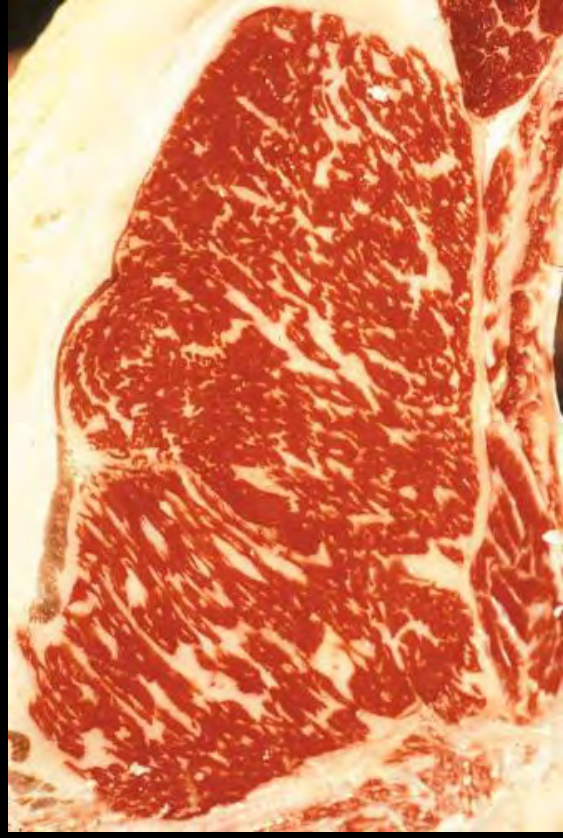
YIELD

ARE

ANTAGONISTS

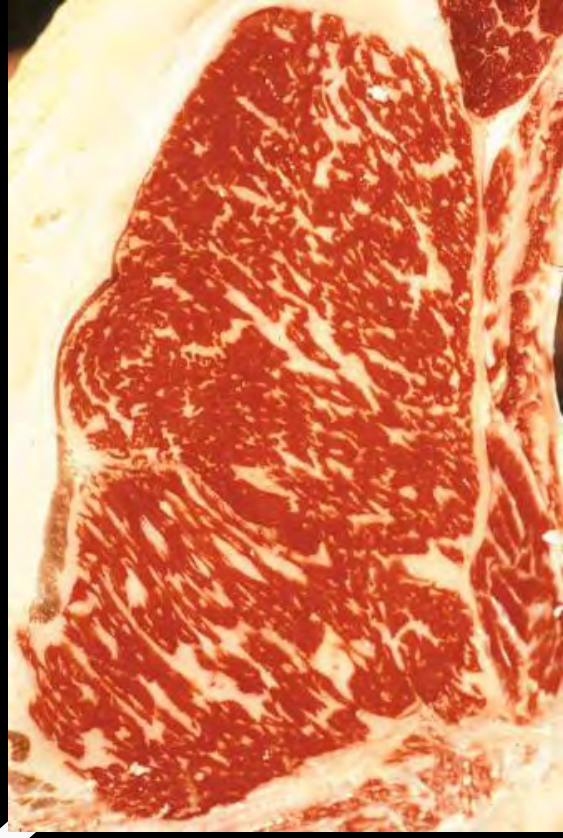






PRIME YG1

0.06%



Our Hypothesis:

CROSSBREEDING PRIMEONE ANIMALS WILL IMPROVE QUALITY AND YIELD

Carcasses Found

n=45

Further DNA-based selection

- Tissue sample from clone candidates are sent to a lab that processes DNA looking for growth, quality, and palatability traits

- **Phenotype**
  - **Prime-YG1**
    - **1 per 1,667**

- **Genotype**
  - **Refine**
    - **1 per 15,555**

Cells cultured for transfer

Mature Oocyte

Select donor cell

Remove the nucleus from oocyte- Enucleation

Transfer of donor cell into the enucleated oocyte

Enucleated Oocyte

Fusion of the cell with the enucleated oocyte

Clone embryo

Transfer cloned embryo into the recipient

Normal gestation/natural birth

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

Alpha 2012

Alpha 2013

PHENOTYPIC

Sex:	Steer
HCW:	782
12th rib fat:	0.44
REA:	15.9
REA/HCW:	2.03
YG:	1.98
Marbling:	Slab70
Hide:	51% Blk

86% Angus

14% Zebu

GENOTYPIC

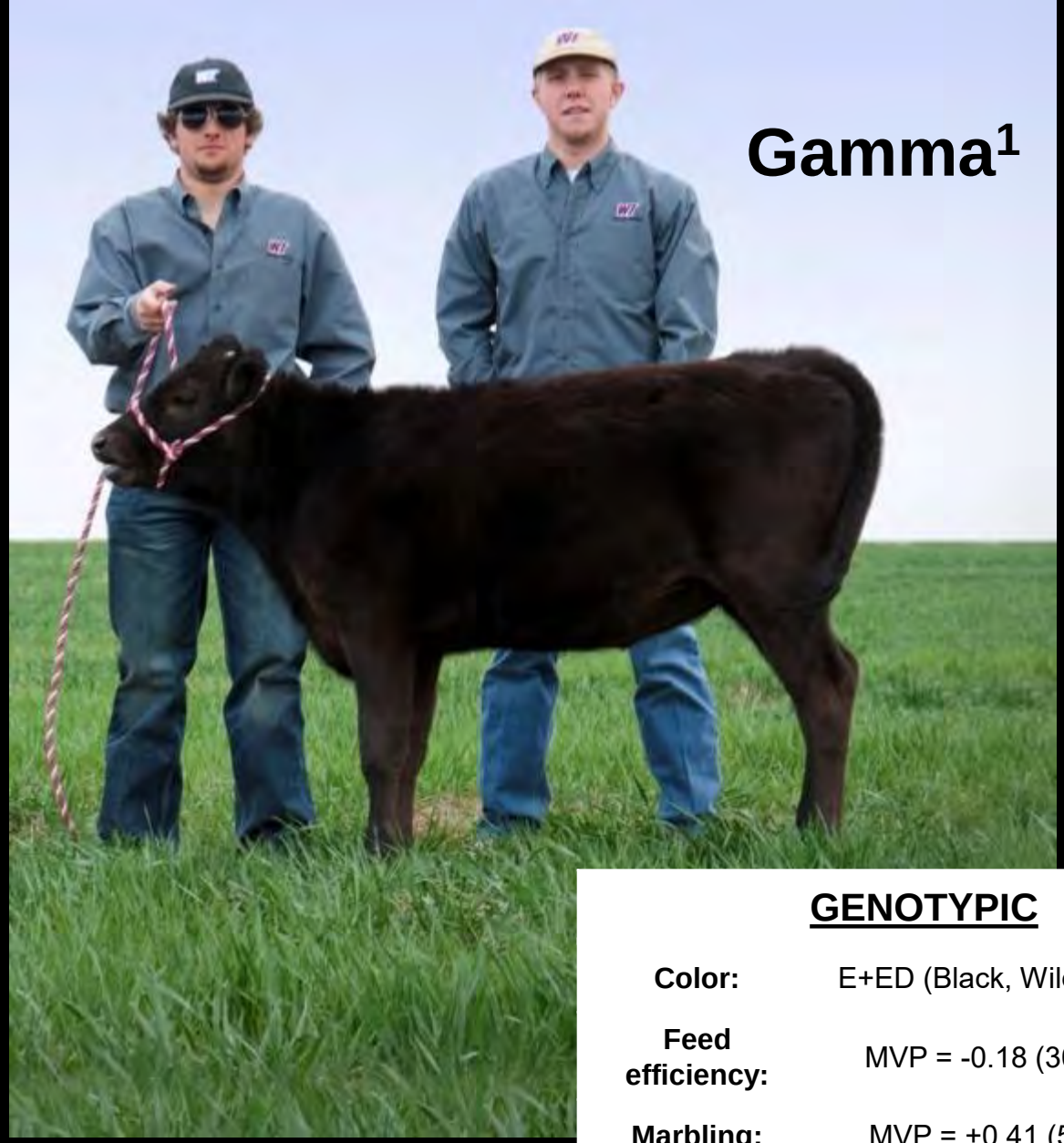
Color:	EDED (Homozygous black)
Feed efficiency:	MVP = -0.76 (10 percentile)
Marbling:	MVP = +0.15 (30 percentile)
Tenderness:	MVP = -0.59 (6 percentile)
Palatability:	MVP = 429 (8 percentile)

Alpha 2016

Photo by David Lust

PHENOTYPIC

Sex:	Heifer
HCW:	708
12th rib fat:	0.16
REA:	15.5
REA/HCW:	2.19
YG:	1.03
Marbling:	Slab[10]
Hide:	51% Blk



GENOTYPIC

Color:	E+ED (Black, Wild type carrier)
Feed efficiency:	MVP = -0.18 (30 percentile)
Marbling:	MVP = +0.41 (5 percentile)
Tenderness:	MVP = -0.28 (30 percentile)
Palatability:	MVP = 454 (6 percentile)

PHENOTYPIC

Sex:	Heifer
HCW:	708
12th rib fat:	0.16
REA:	15.5
REA/HCW:	2.19
YG:	1.03
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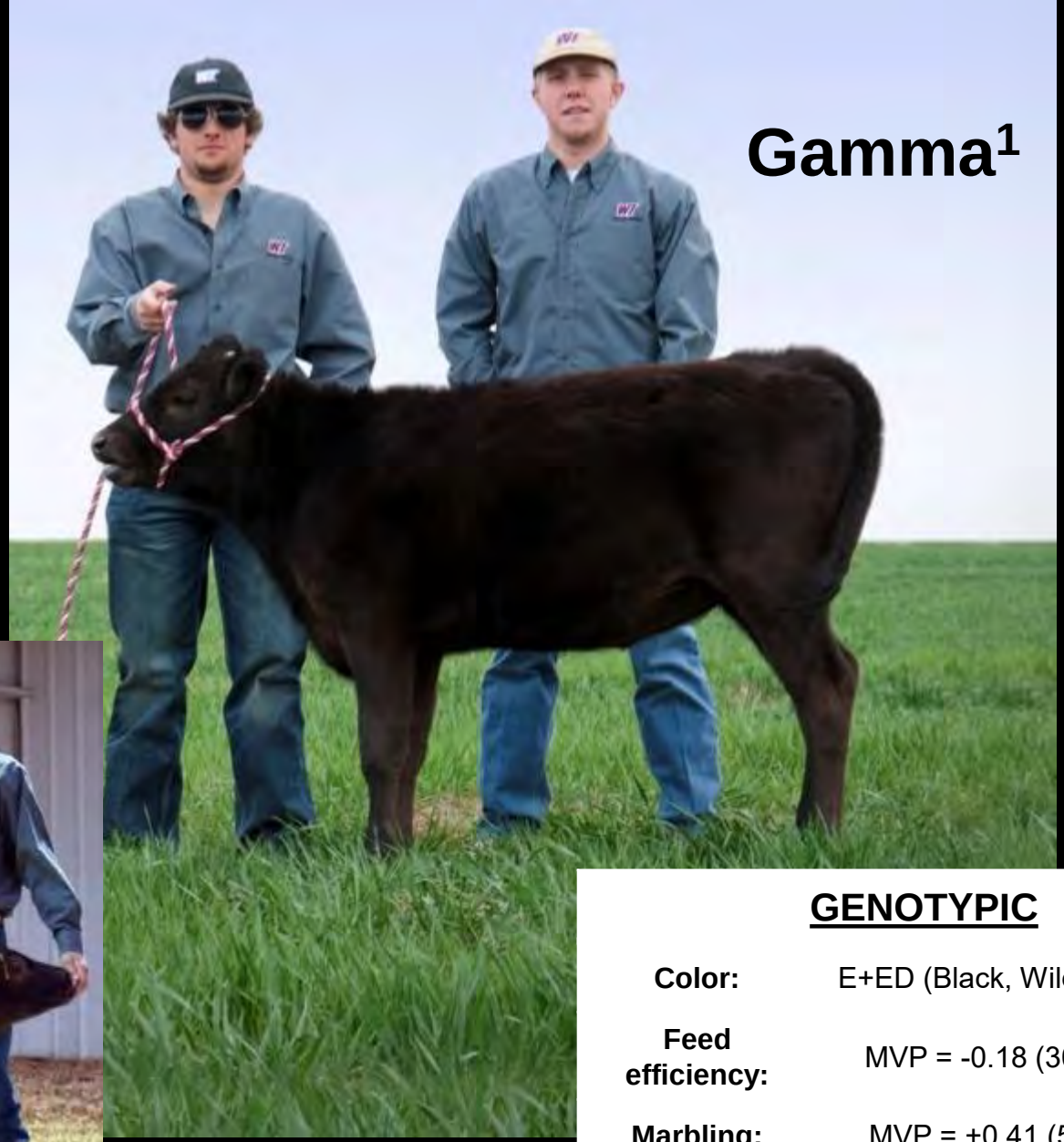

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Tenderness:	MVP = -0.28 (30 percentile)
Palatability:	MVP = 454 (6 percentile)

Experiment 1:
Alpha x Gamma[123]

Alpha x Gamma calves

9 bulls

(7 steers)

4 heifers

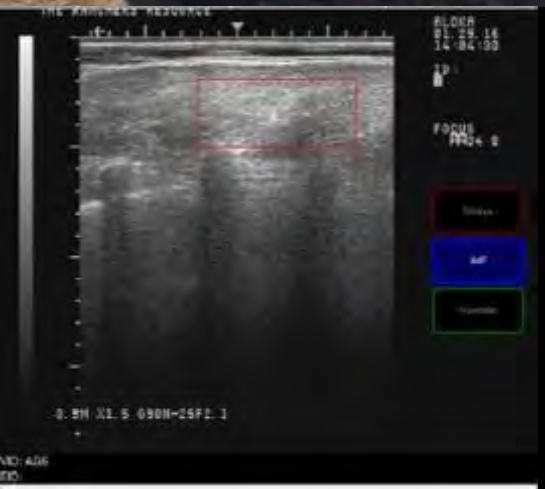
WTAMU Research Feedlot

Alpha x Gamma Calves

7 steers

Alpha x Gamma Calves

7 steers



DOF	BW	Backfat	IMF	Prime	REA
77	916	0.34	8.2%	3/7	12.0
137	1095	0.42	8.7%	4/7	12.9
180	1222	0.50	8.9%	5/7	14.1

MARBLING SCORE

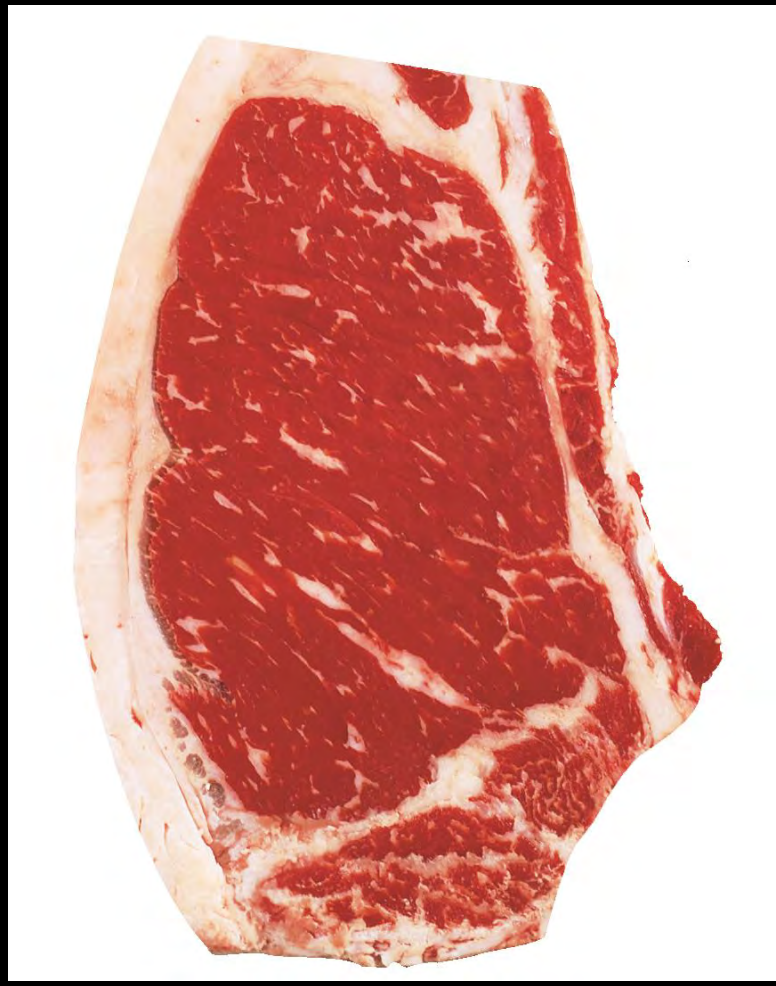
Average steer

Small[40]

+

45%

AxG steers

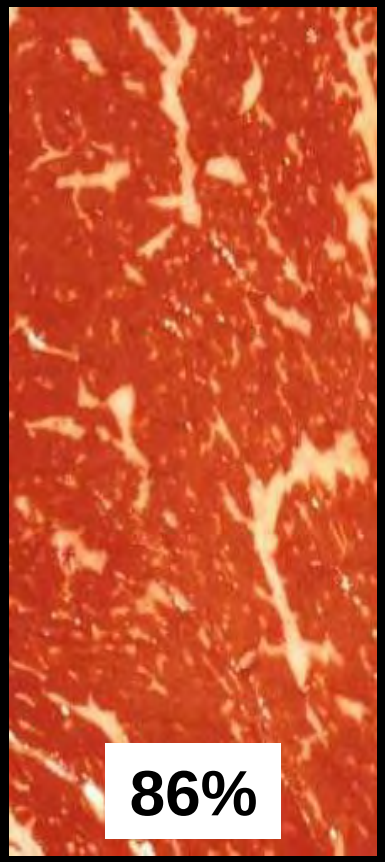


Moderate[30]

AxG Quality Grades

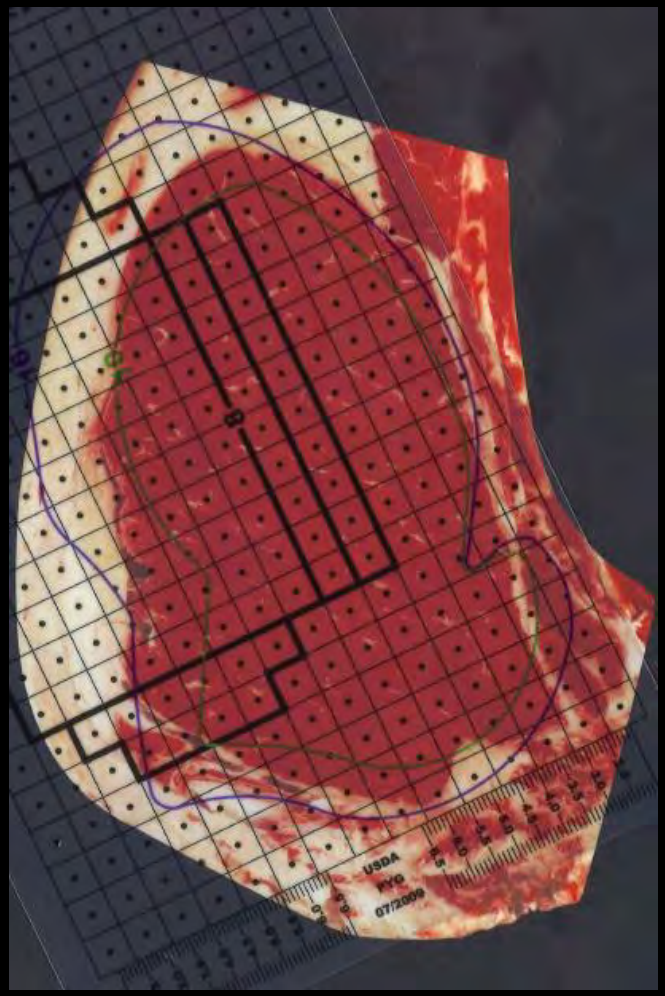
PRIME

PREMIUM CHOICE



RIBEYE AREA

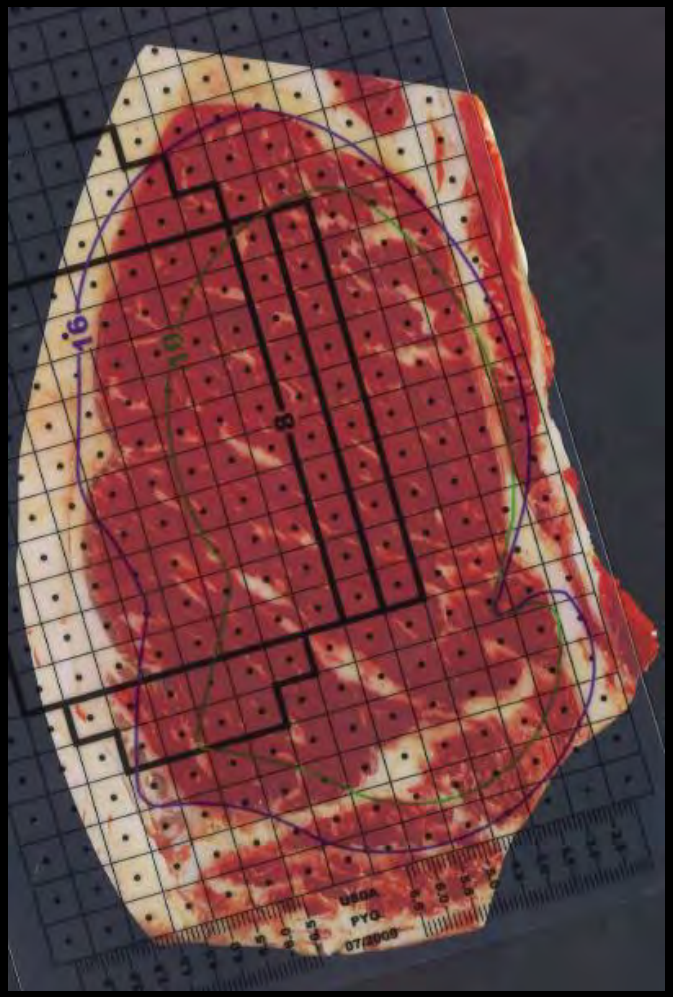
Average steer



13.76 in^2

+ 9%

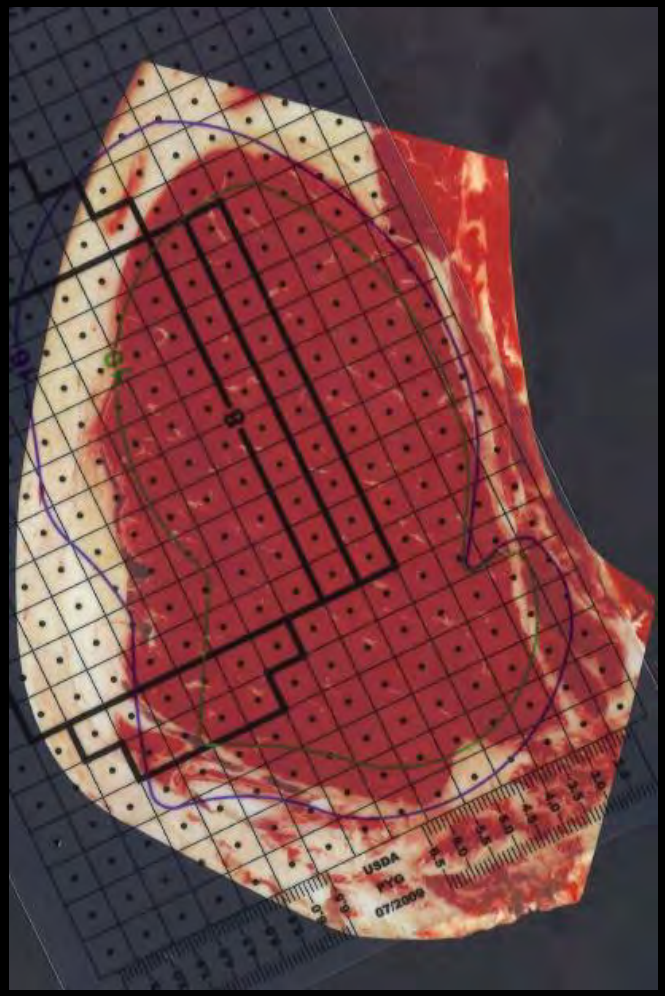
AxG steers



15.03 in^2

REA:HCW^{100}

Average steer

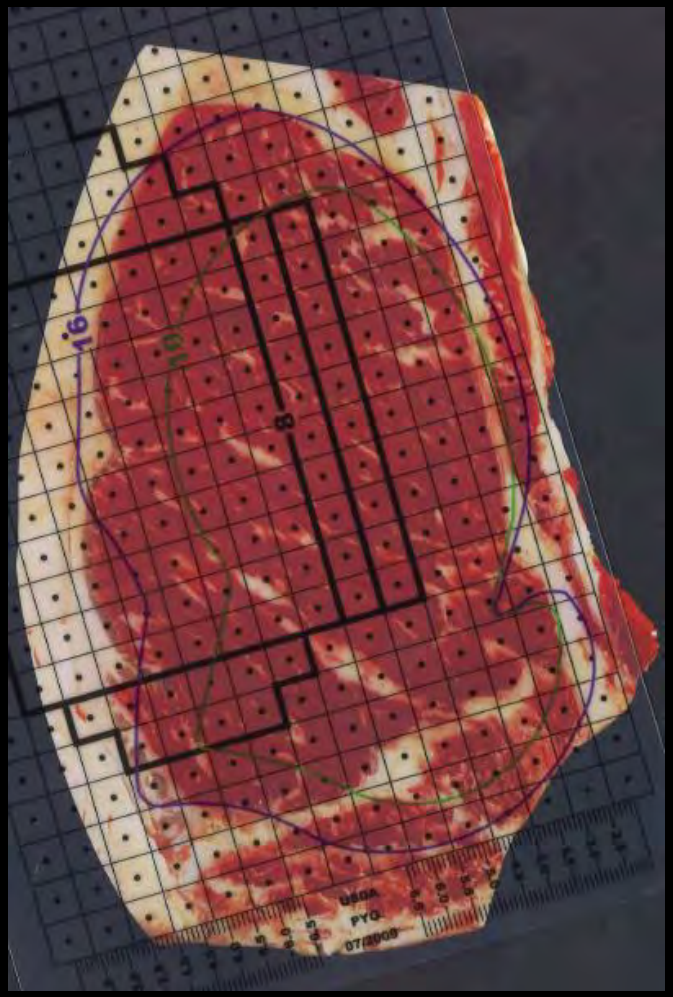


1.67 in^2

+

18%

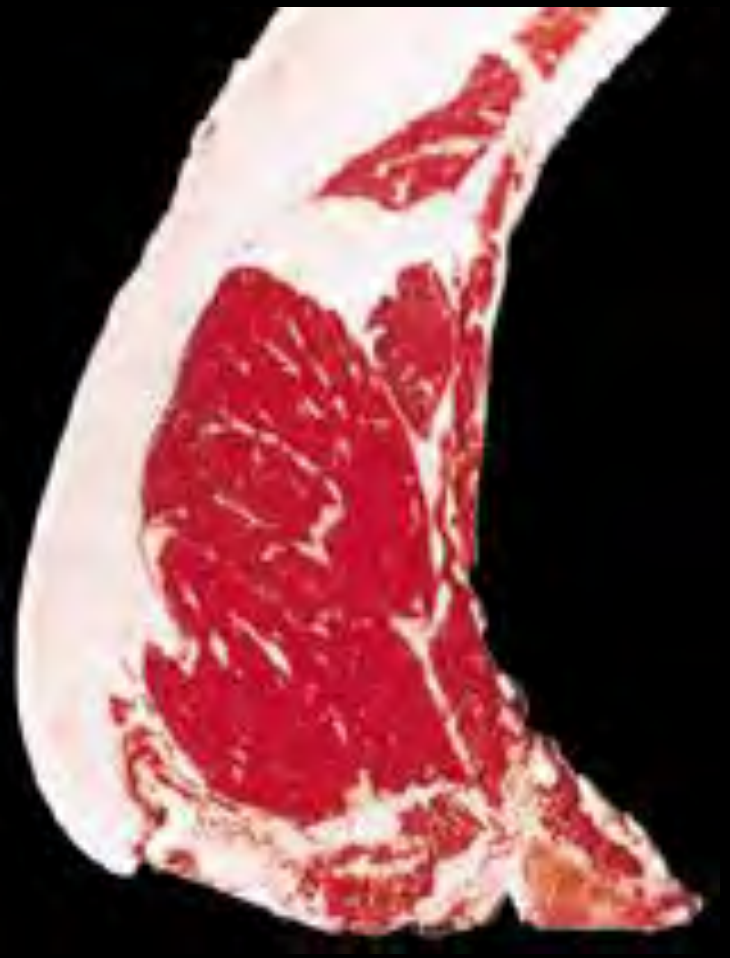
AxG steers



1.96 in^2

YIELD GRADE

Average steer



2.9

- 28%

AxG steers

2.1

AxG Yield Grades

1 2

14% 86%

Experiment 2:

Terminal Sire Comparison

Alpha

WTAMU “Alpha” clone of USDA P1 Carcass

Angus

29AN1688 RIT0 REVENUE

CW	Marb	REA	FAT
+29	+1.53	+.42	+.062
.80	.78	.75	.78
65%	1%	50%	95%

ABS Global, 2018

Simmental

29SM0390 SURE BET

CW	YG	Marb	BF	REA
+16.6	-.49	+.36	-.109	+.78
.84	.62	.83	.78	.82
95%	40%	2%	65%	65%

ABS Global, 2018

Charolais

ANJOU PURE POWER 184Y

CW	REA	FAT	MARB
26	1.01	-0.011	0.07
0.10	0.10	0.08	0.05
15	4	25	60

AICA, 2018

Cow Facility

Feeding Facility

Table 1. Heifer carcass metrics for all sires in study

Outcome	Alpha	Angus	Charolais	Simmental	SEM	*P* - Value
n	41	58	74	50	-	-
Feedlot arrival weight, kg	270.8	259.9	269.9	269.0	15.5	0.07
Hot carcass weight, kg	368.5	369.0	373.1	370.4	6.9	0.82
Fat, cm	1.5^{b}	1.8^{a}	1.1^{c}	1.5^{b}	0.1	<0.01
Longissimus muscle area, cm^2	95.2^{b}	90.2^{c}	99.9^{a}	93.3^{bc}	1.5	<0.01
Calculated yield grade	2.82^{b}	3.44^{a}	2.22^{c}	2.99^{b}	0.1	<0.01
Marbling score[1]	509^{b}	587^{a}	446^{c}	492^{b}	11.6	<0.01
Empty body fat[2], %	30.4^{b}	33.2^{a}	27.8^{c}	30.7^{b}	0.3	<0.01
Total carcass value	1562.90	1565.71	1583.00	1571.66	29.7	0.81
Carcass value per cwt	192.66	192.55	192.47	192.61	0.1	0.47

[1]Marbling score: 400 = small^{00}, minimum required for U.S. Low Choice; 500 = modest^{00}, minimum required for U.S. Premium Choice.

[2]17.76207 + (4.68142 x 12th rib fat, cm) + (0.01945 x HCW, kg) + (0.81855 X quality grade; 4 = Select, 5 = Choice-, 6 = Choice, 7 = Choice+, 8 = Prime) - (0.06754 x longissimus muscle area, cm^2); Guiroy et al. (2002).

No difference ($P > 0.05$) was detected between sire groups for liver and lung health.

Table 2. Steer carcass metrics for all sires in study

Outcome	Alpha	Angus	Charolais	Simmental	SEM	*P* - Value
n	42	50	50	59	-	-
Feedlot arrival weight, kg	293.6[a]	284.3[b]	296.9[a]	297.4[a]	14.6	<0.01
Hot carcass weight, kg	413.8[b]	420.6[ab]	431.3[a]	426.2[a]	7.6	0.05
Fat, cm	1.5[b]	2.0[a]	1.1[c]	1.6[b]	0.08	<0.01
Longissimus muscle area, cm^2	96.8[b]	90.7[c]	102.6[a]	96.2[b]	1.1	<0.01
Calculated yield grade	3.16[b]	4.05[a]	2.59[c]	3.40[b]	0.1	<0.01
Marbling score[1]	504[b]	586[a]	420[c]	489[b]	14.1	<0.01
Empty body fat[2], %	31.4[b]	35.0[a]	28.5[c]	32.0[b]	0.5	<0.01
Total carcass value	1757.91[b]	1787.41[ab]	1831.42[a]	1816.22[a]	31.8	0.04
Carcass value per cwt	192.47[a]	191.92[b]	191.82[b]	192.10[b]	0.1	<0.01

[1]Marbling score: 400 = small[00], minimum required for U.S. Low Choice; 500 = modest[00], minimum required for U.S. Premium Choice.

[2]17.76207 + (4.68142 x 12th rib fat, cm) + (0.01945 x HCW, kg) + (0.81855 X quality grade; 4 = Select, 5 = Choice-, 6 = Choice, 7 = Choice+, 8 = Prime) - (0.06754 x longissimus muscle area, cm^2); Guiroy et al. (2002).

No difference (P > 0.05) was detected between sire groups for liver and lung health.

Table 3. USDA carcass yield and quality grades of heifers

Outcome	Alpha	Angus	Charolais	Simmental	*P* - Value
n	41	58	74	50	-
Quality grade, %					
Prime	2.4	19.0	0	0	0.25
CAB[1]	42.9[a]	43.1[a]	1.4[b]	48.1[a]	<0.01
Choice	47.6[b]	31.0[b]	79.7[a]	50.0[b]	<0.01
Select	7.1	6.9	18.9	1.9	0.06
Yield grade, %					
1	2.4[b]	1.7[b]	47.3[a]	7.7[b]	<0.01
2	71.4[a]	31.0[c]	47.3[bc]	57.7[ab]	<0.01
3	26.2[ab]	46.6[a]	5.4[c]	23.1[b]	<0.01
4	0	20.7	0	0	0.66
5	0	0	0	0	1.0

Table 4. USDA carcass yield and quality grades of steers

Outcome	Alpha	Angus	Charolais	Simmental	*P*- Value
n	42	50	50	59	-
Quality grade, %					
Prime	2.4	22.5	0	0	0.19
CAB[1]	35.7	42.9	0	35.1	0.85
Choice	59.5[a]	32.7[b]	70.0[a]	54.4[a]	0.02
Select	2.4[b]	2.0[b]	28.0[a]	10.5[b]	0.01
Yield grade, %					
1	2.4	0	20.0	3.5	0.06
2	35.7[ab]	2.0[c]	56.0[a]	29.8[b]	<0.01
3	57.1[a]	44.9[a]	22.0[b]	54.4[a]	0.02
4	4.8[b]	46.9[a]	0[b]	12.3[b]	<0.01
5	0	6.1	0	0	1.00

Genetic Evaluation -EPDs

Sire	CW	YG	Mrb	BF	REA
Surebet	16.2	-0.47	0.29	-0.105	0.75
Rito Revenue	30.2	0.33	1.32	0.118	0.17
PurePower	19.9	-1.02	-0.38	-0.256	1.32
ALPHA	**16.2**	**-0.3**	**0.56**	**-0.031**	**0.78**

Experiment 3:

Terminal Sire Comparison

Alpha x Gamma^{1} Bull

Preliminary Results

Carcass characteristics for steer and heifer progeny					
Outcome	Alpha	AxG1	Rampage	Surebet	Protege
n	79	105	72	91	45
HCW, kg	381	387	404	388	396
12th rib fat, cm	1.62	1.55	1.66	1.60	1.65
LM area, cm^2	90.9	93.6	92.7	93.2	89.8
Yield grade	3.29	3.14	3.44	3.23	3.51
Marbling score	Mt 61	Md 10	Mt 46	Mt 32	Mt 28
Prime, %	11.4	23.5	4.1	2.2	4.4
CAB, %	54.4	53.9	42.3	53.9	37.8
Choice, %	34.2	21.6	46.6	42.9	48.9
Select , %	0	1.0	6.9	1.1	8.9
YG 1, %	1.3	6.9	2.7	2.2	4.4
YG 2, %	36.7	30.4	23.3	33.0	15.6
YG 3, %	44.3	53.9	52.1	50.6	51.1
YG 4, %	16.5	8.8	20.6	14.3	28.9
YG 5, %	1.3	0	1.4	0	0

Summary

- Alpha progeny performed comparably to high performing reference sires for terminal sire production traits
- AxG1 progeny outperformed high performing reference sires for terminal sire production traits

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

For More Information

Ty Lawrence, Ph.D.
Professor of Animal Science
Director, Beef Carcass Research Center
West Texas A&M University
WT Box 60998
Canyon, TX 79016
Office – 806-651-2560
Mobile – 806-681-9861
BCRC – 806-651-2275
Meat Lab – 806-651-2565
Fax – 806-651-2938
Email – tlawrence@wtamu.edu

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