Beef Cattle Genetics and Feed Efficiency in Beef Cattle in Florida

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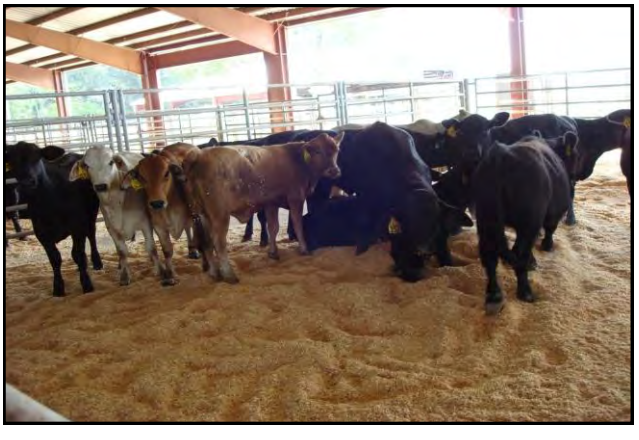
- FEF - BRU Calves 2006 - 2007
- Data Recording Prior to FEF
- Data Recording at FEF
- Current FEF Research
- Future FEF Research



Data Recording Prior to FEF

Pedigree and Breed Fractions
{Calves, Sires, Dams}

Data: 2 {Date and information}
{Date, weight, height, condition score, …}

Provided at the time animals are brought into the FEF

Data Recording at BRU

Pedigree and Breed Fractions
{Calves, Sires, Dams}

Data: 6 {Date and information}
{Date, weight, height, condition score, …}
Files: {Calf, Sire, Dam}
Yearly and Accumulated

Data Recording at FEF

Calves: Bulls, Heifers, Steers
AdjPeriod: 21 d; Trial:70 d
Pens: 24; Calves/pen: 14 - 16

Intake: Feed, Water (Real time)
Growth: Dates, weights, Hip Ht (2 wk)
Temperament: Chute Score, Exit Velocity (2 wk)
Ultrasound: UREA, UIMF, UBF, UTend

Post-FEF Data Recording

Carcass and Meat Quality Data (BRU Only)

Growth: Date, Slaughter weight
Carcass: HCW, BF, REA, KPH, MAR, YG, QG
Meat Quality: Shear Force, Tenderness, Juiciness, Flavor, Cook Loss, Thaw Loss

Postweaning Feed Efficiency Analysis

Data: 581 calves (2006 – 2007)
Growth
Feed Consumption

Brooksville (100 calves)
Gainesville (388 calves)
Marianna (93 calves)

Traits

Residual Feed Intake (RFI)
Daily Feed Intake (DFI)
Feed Conversion Ratio (FCR)
Postweaning Gain (PWG)

Calves 2006-2007 BKV-GNV-MAR

n = 581	Breed Group of Sire					
BGDam	A	.75 A	Br	.50A	.25A	B
A	80	7	42	7	8	21
.75 A	18	9	7	9	12	11
Br	16	2	70	2	3	4
.50A	18	17	24	11	16	20
.25A	8	6	6	8	6	5
B	14	0	0	0	0	84

Usual Model for RFI

Daily feed intake
=
Avge daily gain
+
Metabolic Mid-wt
+
Residual feed intake

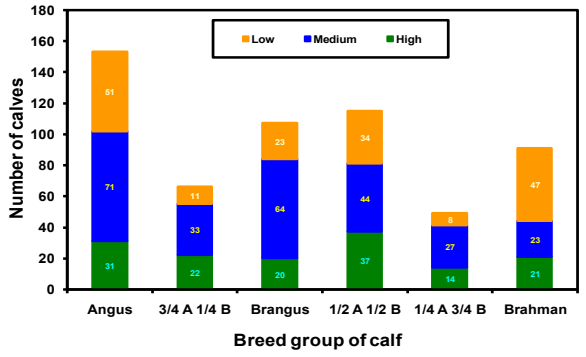
RFI groups

High = RFI > 0.9 kg DM/d

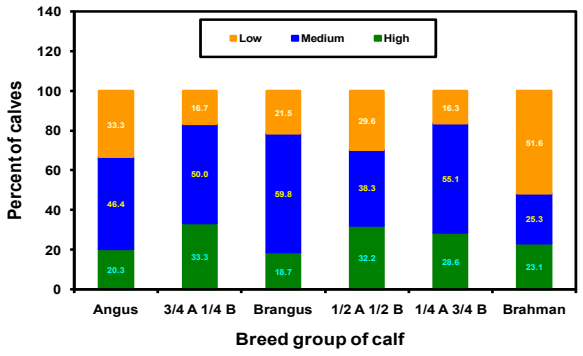
Med = - 0.9 kg DM/d ≤ RFI ≤ 0.9 kg DM/d

Low = RFI < - 0.9 kg DM/d

Residual Feed Intake



Residual Feed Intake



Model for RFI

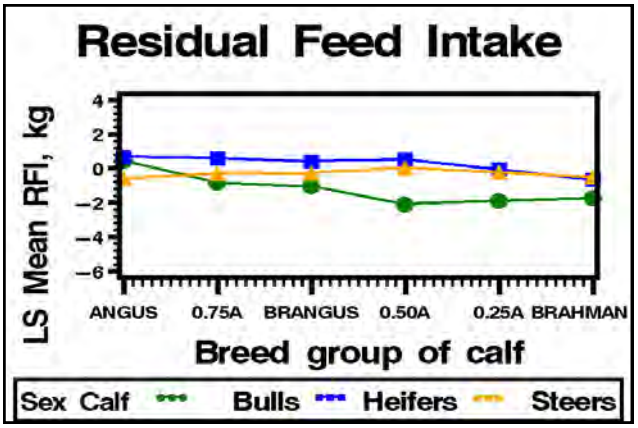
RFI
=
herd-year-pen + age of dam
+ sex of calf + age calf
+ BFCalf(sex)+ Hetcalf(sex)
+ mean chute score + mean exit velocity
+ sire + residual

	Trait			
Effect	RFI	DFI	FCR	PWG
Herd-year-pen	< 0.0001	< 0.0002	< 0.0001	< 0.0001
Age of dam	0.41	0.12	0.65	0.28
Sex of calf	0.003	< 0.0001	< 0.0001	< 0.0001
Age of calf	0.06	0.01	0.0004	0.04
RFI group		< 0.0001	0.78	0.09
Brahman fraction nested within sex of calf	< 0.0001			
Heterosis nested within sex of calf	0.24			
Brahman fraction nested within RFI group		0.0009	0.0073	0.0004
Heterosis nested within RFI group		0.0002	0.22	0.20
Mean Chute Score	0.39	0.42	0.11	0.33
Mean Exit Velocity	0.89	0.0012	0.34	0.31

Residual Feed Intake

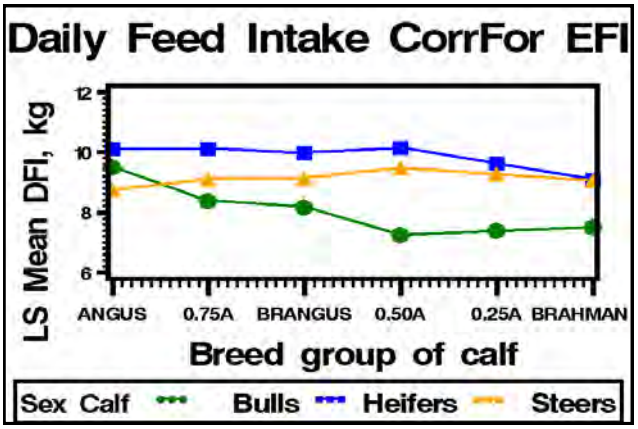
Bulls similar to Steers
Heifers less efficient than steers
(1.24 ± 0.36 kg DM/d)

Bulls and Steers: Similar RFI from A to B
Heifers: RFI decreased as B % increased
(-1.29 ± 0.28 kg DM/d; more efficient)



Model for DFI Corrected for EFI

DFI
=
Adg + MetabMidWt
herd-year-pen + age of dam
+ sex of calf + age calf
+ BFCalf(sex)+ Hetcalf(sex)
+ mean chute score + mean exit velocity
+ sire + residual



Model for FCR, DFI, PWG

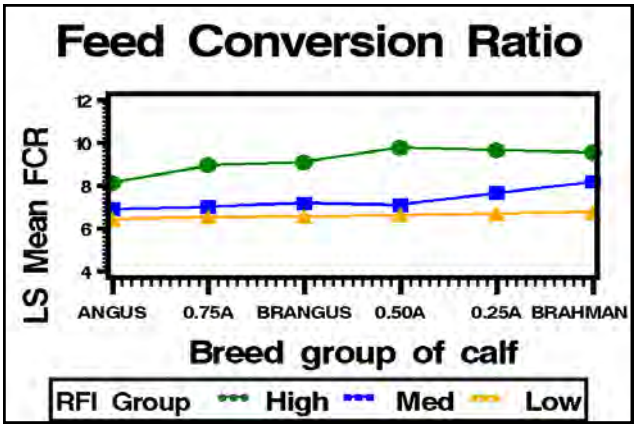
FCR, DFI, PWG
=
herd-year-pen + age of dam
+ sex of calf + age calf +
RFI group + BFcalf(rfigrp) + Hetcalf(rfigrp)
+ mean chute score + mean exit velocity
+ sire + residual

	Trait			
Effect	RFI	DFI	FCR	PWG
Herd-year-pen	< 0.0001	< 0.0002	< 0.0001	< 0.0001
Age of dam	0.41	0.12	0.65	0.28
Sex of calf	0.003	< 0.0001	< 0.0001	< 0.0001
Age of calf	0.06	0.01	0.0004	0.04
RFI group		< 0.0001	0.78	0.09
Brahman fraction nested within sex of calf	< 0.0001			
Heterosis nested within sex of calf	0.24			
Brahman fraction nested within RFI group		0.0009	0.0073	0.0004
Heterosis nested within RFI group		0.0002	0.22	0.20
Mean Chute Score	0.39	0.42	0.11	0.33
Mean Exit Velocity	0.89	0.0012	0.34	0.31

Feed Conversion Ratio

Breed
Increased as B % increased (less efficient)
High RFI Group = 1.41 ± 0.52 kg DM*d^{-1}/kg gain*d^{-1}
Med RFI Group = 1.29 ± 0.47 kg DM*d^{-1}/kg gain*d^{-1}

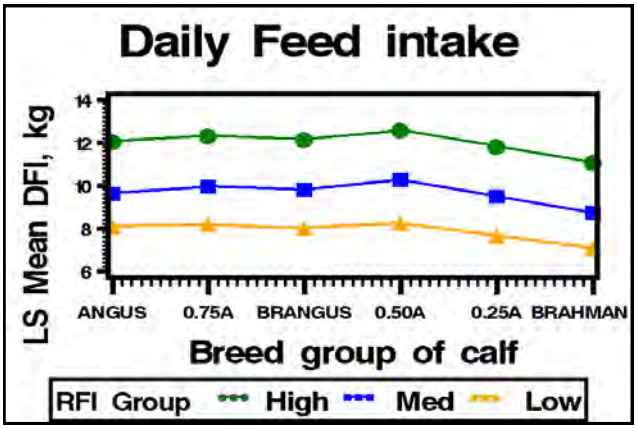
Heterosis
Increased as Het % increased (less effic)
High RFI Group = 0.92 ± 0.51 kg DM*d^{-1}/kg gain*d^{-1}



Daily Feed Intake

Breed
Decreased as B % increased (more effic)
High RFI Group = -0.97 ± 0.38 kg DM/d
Med RFI Group = -0.90 ± 0.33 kg DM/d
Low RFI Group = -0.99 ± 0.31 kg DM/d

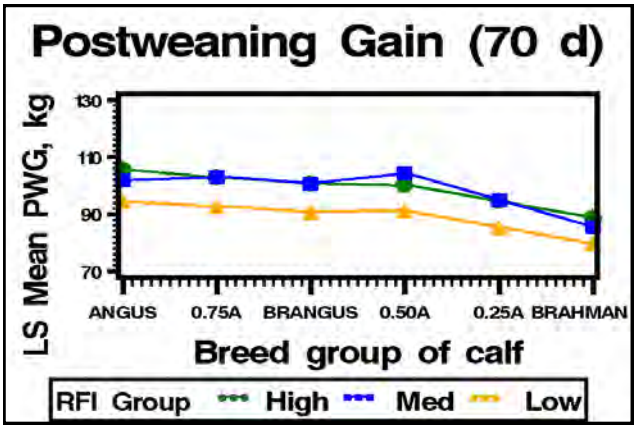
Heterosis
Increased as Het % increased (less effic)
High RFI Group = 1.01 ± 0.35 kg DM/d
Med RFI Group = 1.09 ± 0.32 kg DM/d



Postweaning Gain (70 d)

Breed
Decreased as B % increased (A better)
High RFI Group = -18.81 ± 5.98 kg
Med RFI Group = -16.18 ± 5.28 kg
Low RFI Group = -14.82 ± 4.85 kg

Heterosis
Increased as Het % increased (favorable)
Med RFI Group = 10.59 ± 5.88 kg



Temperament

Mean Chute Score
No effect on any trait

Mean Exit Velocity
No effect on RFI, FCR, PWG
DFI (-0.29 ± 0.09 kg DM*d^{-1}/m*sec^{-1})
Higher feed intake => lower EV

Genetic Parameters (REML)

	RFI	DFI	FCR	PWG
RFI	0.19 ± 0.11	0.73 ± 0.13	0.09 ± 0.38	0.58 ± 0.28
DFI	0.89 ± 0.01	0.42 ± 0.13	-0.05 ± 0.31	0.88 ± 0.12
FCR	0.55 ± 0.03	0.37 ± 0.04	0.24 ± 0.11	-0.50 ± 0.23
PWG	0.15 ± 0.04	0.41 ± 0.04	-0.57 ± 0.03	0.40 ± 0.13

Research: Genetics-Genomics

Estimate effect of genes associated with growth and FE in animals from different breed compositions (100% Angus to 100% Brahman)

Estimate effect of genes associated with growth traits at various ages (birth to slaughter)

Use high density panels to estimate the breed composition of animals for individual traits in multibreed populations
(Improve accuracy of genetic predictions)

Research: Physiology-Nutrition

Fine mapping of growth and FE QTL regions
Identification of relevant genes under subtropical conditions (Bos taurus-Bos indicus)

Physiological role / effect of relevant genes for growth and FE in subtropical multibreed cattle (Bos taurus-Bos indicus)

Variability in gene expression of relevant growth and FE genes in multibreed Bos taurus-Bos indicus populations in subtropical regions

Appendix

Carcass (2006-2007) UF Angus-Brahman Herd

n = 170	Breed Group of Sire					
BGDam	A	.75 A	Br	.50A	.25A	B
A	17	2	2	2	3	4
.75 A	6	4	8	5	3	4
Br	2	1	18	1	1	2
.50A	5	10	10	6	5	5
.25A	5	3	2	4	1	2
B	0	0	0	0	0	27

Model for Carcass Traits

HCW, LMA, BFAT, MAR, SF, TEND
=
year-pen + age calf +
RFI group + BFcalf(rfigrp) + Hetcalf
+ mean exit velocity
+ sire + residual

Regression of Carcass & Meat Quality traits on Brahman Fraction

Trait	P > F	High RFI	Medium RFI	Low RFI
HCW	0.0006	-65.7 ± 22.1 kg	-42.4 ± 23.5 kg	-43.3 ± 18.2 kg
LMA	0.0001	-8.08 ± 5.0 cm^2	-14.6 ± 5.3 cm^2	-17.9 ± 4.1 cm^2
BFAT	0.0207	-1.08 ± 0.4 cm	-0.4 ± 0.4 cm	-0.1 ± 0.3 cm
MAR	0.0001	-170.7 ± 44.1 units	-182.2 ± 46.7 units	-38.7 ± 36.3 units
SF	0.0003	1.3 ± 0.3 kg	0.6 ± 0.3 kg	0.2 ± 0.3 kg
TEND	0.0001	-0.9 ± 0.3 units	-1.7 ± 0.3 units	-0.9 ± 0.3 units

Carcass Traits
Feed Efficiency Group

High RFI smaller LMA than Low RFI
(-11.0 ± 3.8 cm^2)

High RFI higher MAR than Low RFI
(116.0 ± 34.0 units)
Medium RFI higher MAR than Low RFI
(108.0 ± 29.9 units)

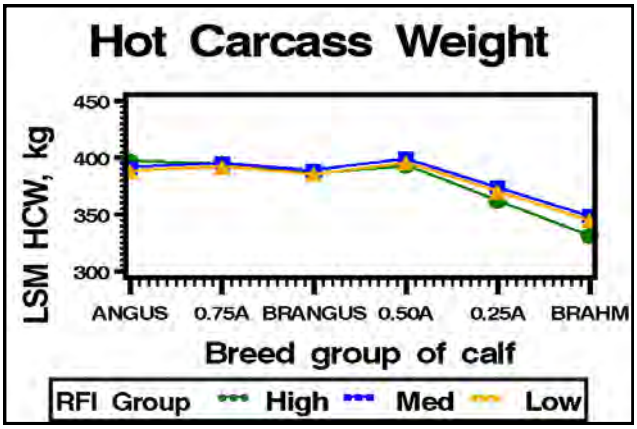
Carcass Traits

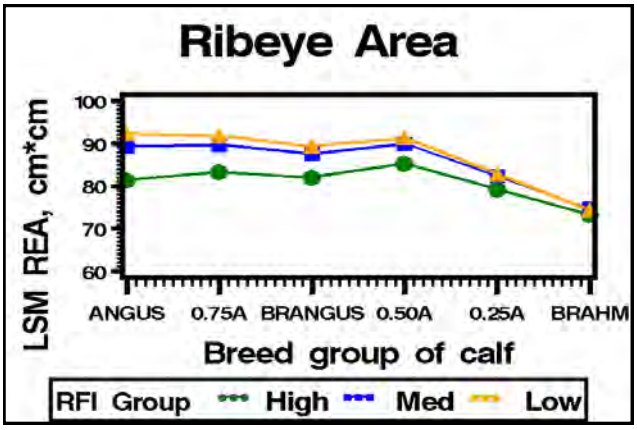
Less efficient steers (High RFI) had smaller LMA than more efficient steers (Low RFI)

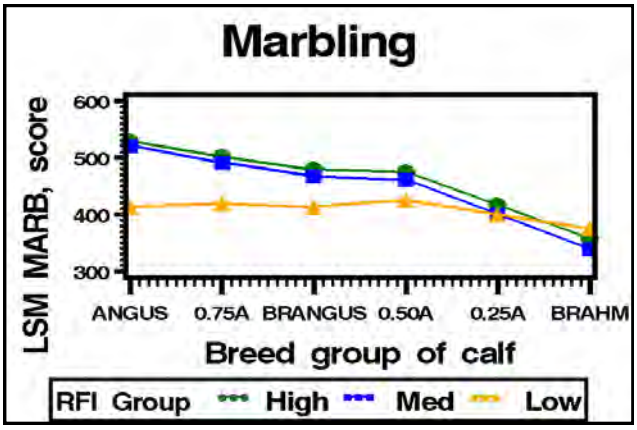
HCW, LMA, BFAT, MAR, and TEND decreased as Brahman fraction increased

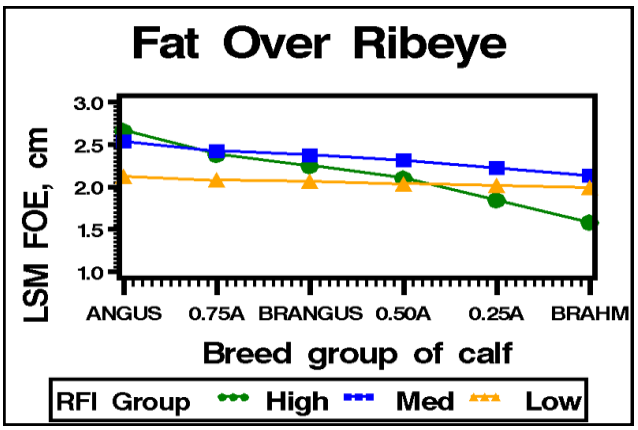
LMA increased heterozygosity increased

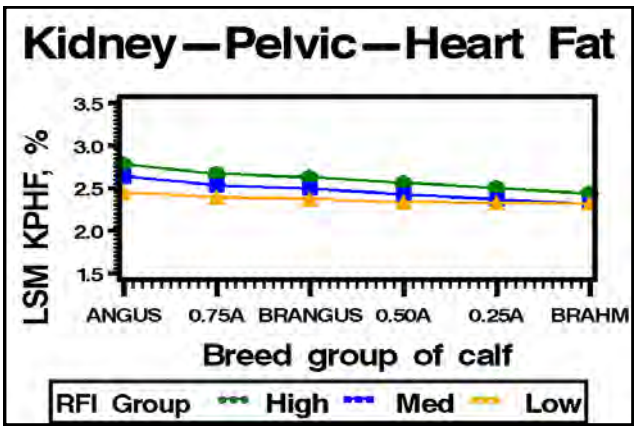
EV had no effect on carcass and meat quality traits

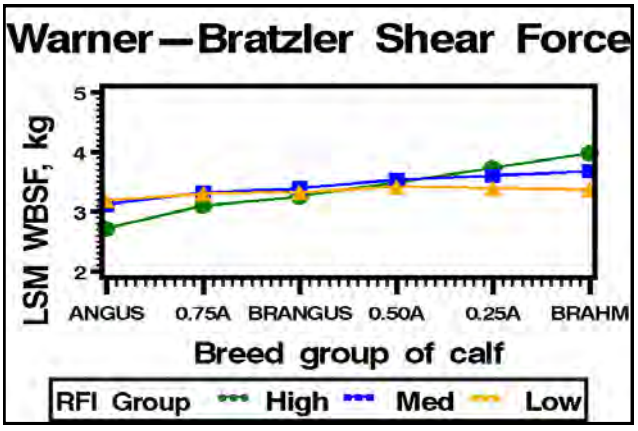


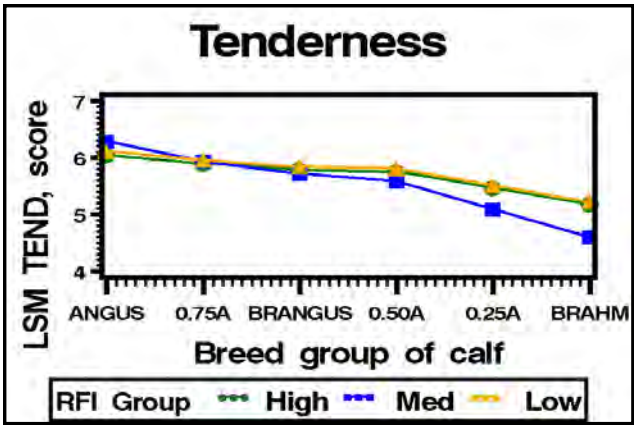


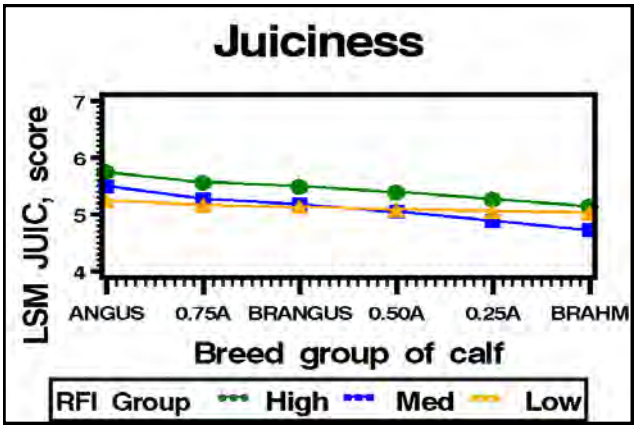


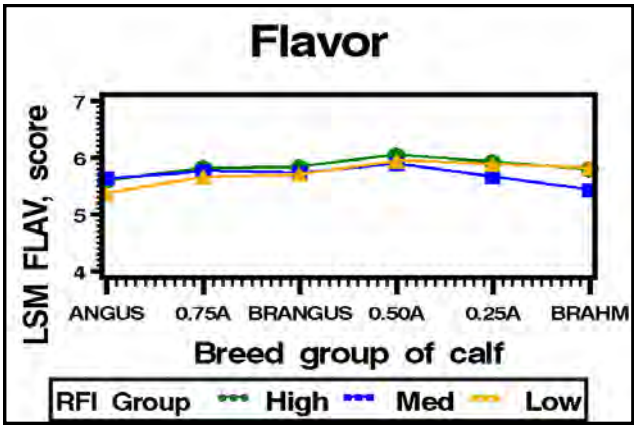

Fat Over Ribeye
LSM FOE, cm
3.0
2.5
2.0
1.5
1.0
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low

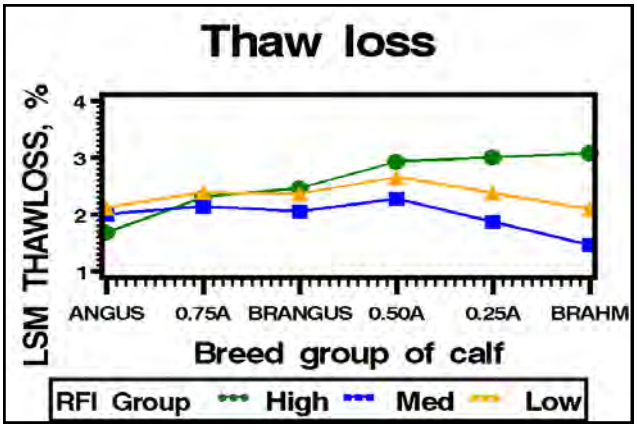

Kidney—Pelvic—Heart Fat
LSM KPHF, %
3.5
3.0
2.5
2.0
1.5
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low

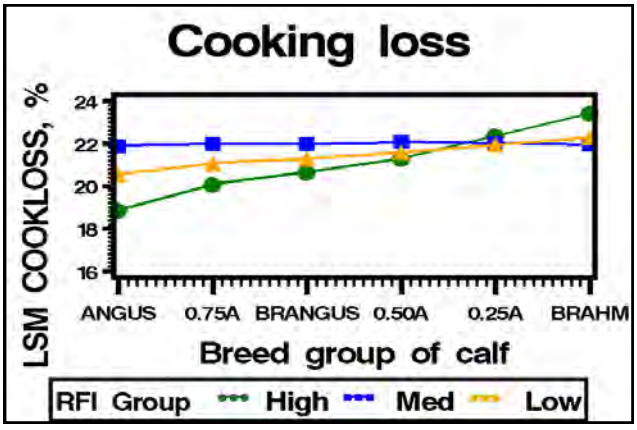

Warner—Bratzler Shear Force
LSM WBSF, kg
5
4
3
2
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low


Tenderness
LSM TEND, score
7
6
5
4
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low


Juiciness
LSM JUIC, score
7
6
5
4
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low


Flavor
LSM FLAV, score
7
6
5
4
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low


Thaw loss
LSM THAWLOSS, %
4
3
2
1
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low


Cooking loss
LSM COOKLOSS, %
24
22
20
18
16
ANGUS
0.75A
BRANGUS
0.50A
0.25A
BRAHM
Breed group of calf
RFI Group
High
Med
Low