

*Collaborative international
carcase grading and
consumer testing activity by
Texas Tech University*

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TEXAS TECH UNIVERSITY

International Beef Consumer Work

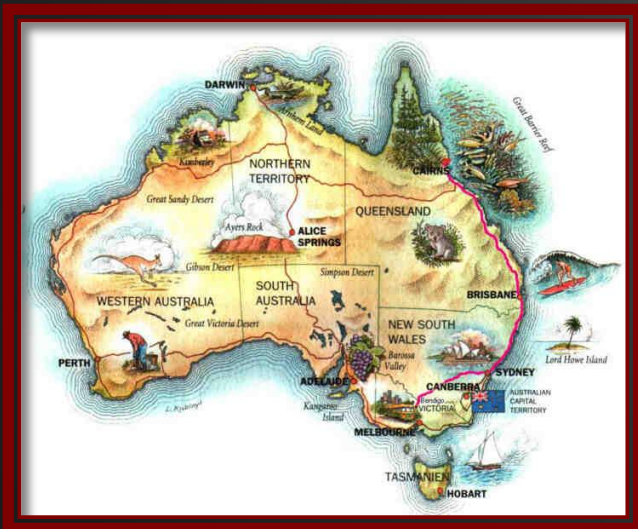
Australian based testing (2005)

Australian

- 4320 test samples paired to USA plus 1st position link samples
- 432 cuts paired to USA
- 54 cattle paired to USA

USA

- 1440 consumers (480/city; 240/cook method/city)
- 8640 test samples plus 1st position link samples
- 864 cuts (10 consumers per sample)
- 108 source cattle (54 AUS/54 USA)



Grading Results

Australian Cattle

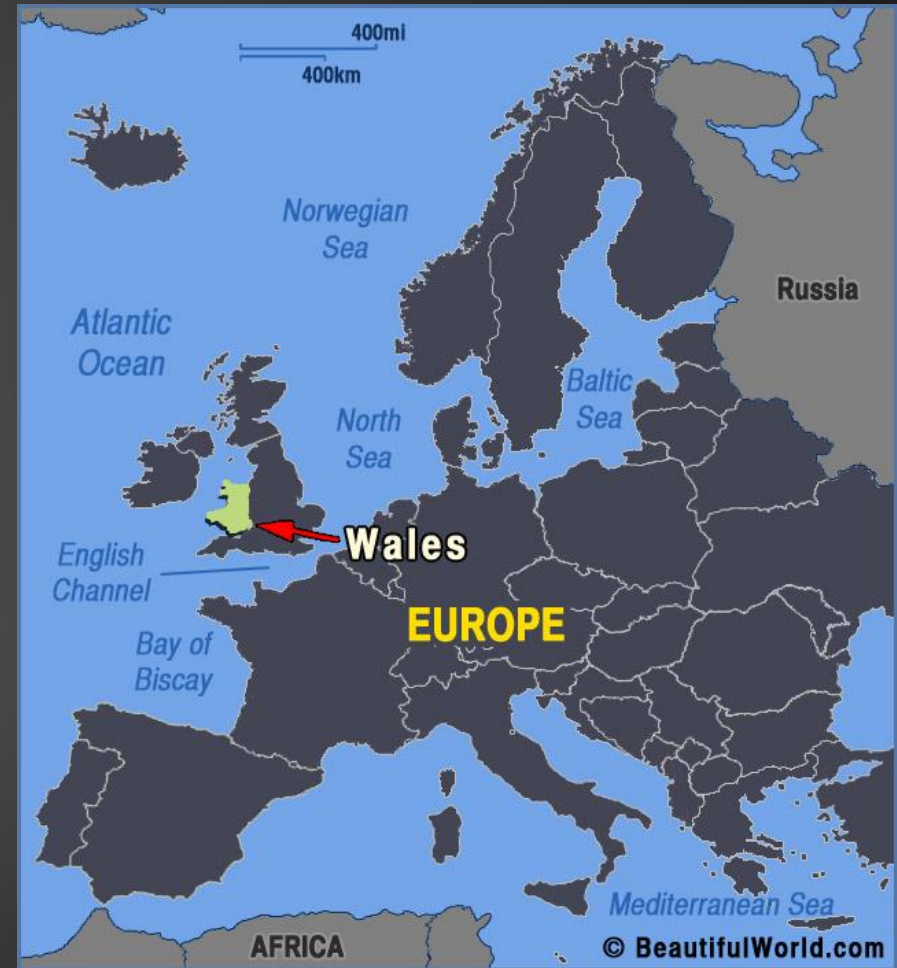
USA Cattle

	Grass	70 Day	188 Day	Select	High Choice
HSCW	293	261	447	367	359
Uoss	146	151	206	172	179
Umb	332	310	509	409	616
Aus Mb	0.7	0.6	2.5	1.7	3.2
TBC%	0	0	0	0	0
HGP	No	Yes	Yes	Yes	Yes
DOF	-	70	188	146 – 220	146 - 220
pHU	5.6	5.5	5.5	5.5	5.5

*All USA cattle collected from Nebraska Beef, Omaha Neb.
Carcasses graded by Janine Lau (MSA) and Jimmy Wise (USDA)
Carcasses selected to equally represent each 10th of each grade by marbling*

Welsh based testing

- ▶ Carcass grading (2010)
 - ▶ 2068 carcasses with MSA grade inputs
- ▶ Consumer testing
 - ▶ Data used to estimate consumer satisfaction for individual muscles and relationship to carcass categories.
 - ▶ A sub set (2 picks - 1 roast and 1 grill) were used to prove that the predictions were reasonable and that good and bad could be predicted within existing categories



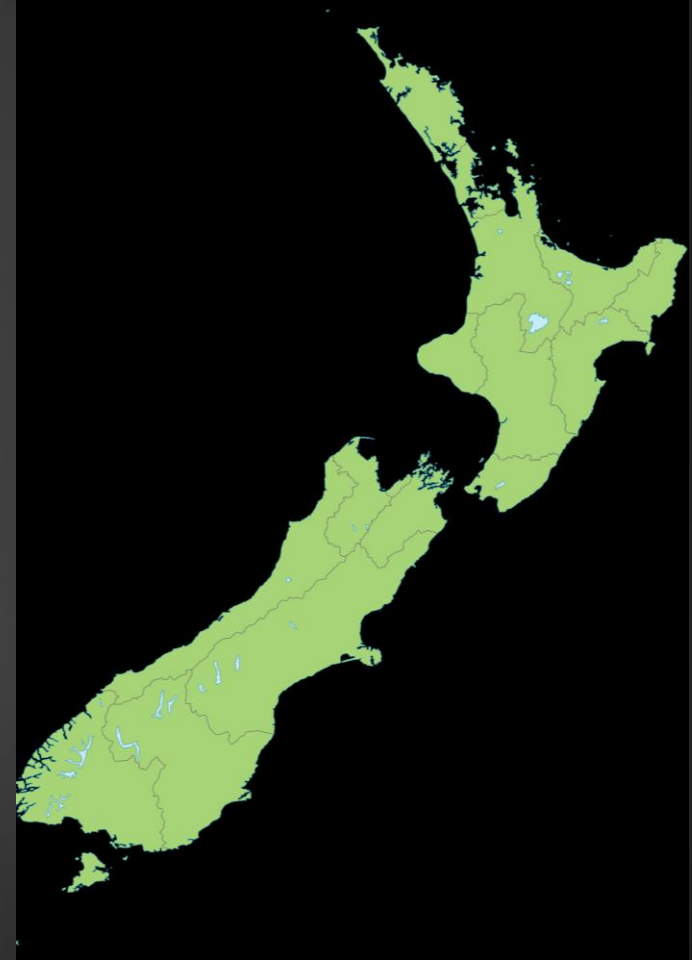
Polish based testing

- ▶ Carcass grading (2010-2015)
 - ▶ MSA input data collected
 - ▶ 17 different dates
 - ▶ 10 slaughterhouses
- ▶ Consumer testing
 - ▶ 9780 consumers
 - ▶ Processing benchmarks
 - ▶ Test muscle x cook
 - ▶ Gender – bull, heifer, cow
 - ▶ Wide range of marbling and ossification
 - ▶ Postmortem aging 5 to 35 days
 - ▶ TX vs. AT hanging method



New Zealand based testing

- ▶ Cattle/meat derived from New Zealand
 - ▶ Depending on the trial, compared to US beef
- ▶ Consumer testing
 - ▶ US
 - ▶ New Zealand
 - ▶ Depending on the trial, either completely based in US (solely in Texas or nationwide) or mirror trials in New Zealand and US



Chiller Assessment

- ▶ TTU provided up to 3 staff in New Zealand on three occasions surrounding the three main sampling periods to work on carcass assessment.
- ▶ Collected data on nearly 21,000 beef carcasses between the 3 chilled plants
- ▶ Served as baseline for data collecting procedures and highlighted variation in carcass quality that existed between season, island, and gender
- ▶ Master EQ graders were trained and certified using alternative methods as those provided by TTU with slight variations in standards for key impact traits, but their chiller assessments allow the daily selection and marketing of Reserve Beef in New Zealand and abroad



	August 2012	November 2012	April 2013
Belfast			
Bull	41	236	27
Heifer	417	938	272
Steer	1369	2330	873
Finegand			
Bull		194	14
Heifer		1543	323
Steer		1810	611
Pacific			
Bull	95	2215	57
Heifer	323	1018	139
Steer	946	3751	1095
TOTAL	3191	14035	3411

Variable	All carcasses	EQ Selected carcasses	Belfast	Finegand	Pacific	Bull	Heifer	Steers
N	20637	218	6503	4495	9639	2879	4973	12785
Hump, mm	48.2	48.2	48.5	41.5	51.1	68.1	37.6	47.8
HCW	302.0	285.1	293.4	285.5	315.4	326.9	258.9	313.1
Marbling	358	326	388	388	323	222	380	380
Meat Colour	225	249	186	259	236	336	215	204
Ossification	161	166	157	172	159	180	179	150
Ribfat, mm	5.6	6.0	5.9	4.9	5.8	1.1	6.0	6.5
pH	5.62	5.63	5.62	5.52	5.67	5.95	5.55	5.57
EMA, cm²	73.2	72.9	71.8	66.5	77.4	81.9	68.1	73.3
Dentition	3.0	2.4	2.8	2.7	3.3	2.7	2.6	3.3
Temp, °C	5.4	4.5	5.1	5.2	5.7	4.9	5.3	5.6

Marbling (USDA Grade)	MSA marbling range	US marbling range
High Standard (Traces)	200 – 290	200 – 290
Select (Slight)	300 – 390	300 – 390
Low Choice (Small)	400 – 590	400 – 490
Top choice (Modest/Moderate)	600 – 790	500 – 690
Prime (Slightly Abundant+)	800+	700+

U.S. EQ Consumer Testing

- ▶ Over the course of 15 months (September, 2012 – November, 2013) TTU managed and undertook consumer testing across the continental U.S., totaling 9,840 U.S. consumers
 - ▶ 2,880 consumers were fed at 12 sites across the country including Dallas, TX; Los Angeles, CA; San Francisco, CA; Seattle, WA; Phoenix, AR; Denver, CO; Chicago, IL; Kansas City, MO; Atlanta, GA; Philadelphia, PA; Baltimore, MD; Boston, MA
 - ▶ The balance ($n = 6,960$) of consumers were fed on the TTU campus (Lubbock, TX), with a subset of those consumer samples ($n = 1,000$) being fed in Houston, TX.
 - ▶ Picks were allocated as 1 of 4 cooking methods as prescribed at cut-up
 - ▶ Grill (80) = 4,800
 - ▶ Roast (41) = 2,460
 - ▶ Stew (37) = 2,220
 - ▶ Stir Fry (6) = 360



NZ EQ Consumer Testing



- ▶ 3,960 NZ consumers were fed at 2 main sites in Dunedin or Auckland, with the balance being fed to SFF employees at Pacific, Finegand, and Head Office
- ▶ Picks were allocated as 1 of 3 cooking methods as prescribed at cut-up
 - ▶ Grill (37) = 2,220
 - ▶ Roast (20) = 1,200
 - ▶ Stew (9) = 540

Winter Beef Finishing Trial

Consumer testing

1140 consumers (TX)

Fodder Beet

- High Marbling
- Low Marbling

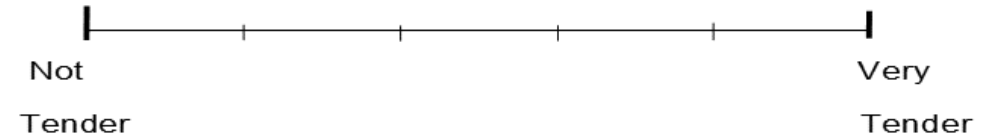
Non Fodder Beet

- High Marbling
- Low Marbling

US grain fed beef

- Top Choice (high marbling)
- Select (low marbling)

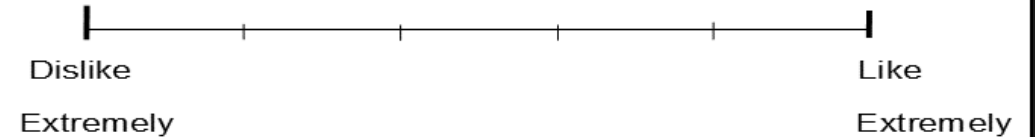
Tenderness



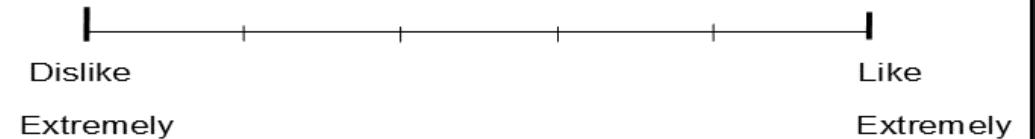
Juiciness



Liking of flavour



Overall Liking



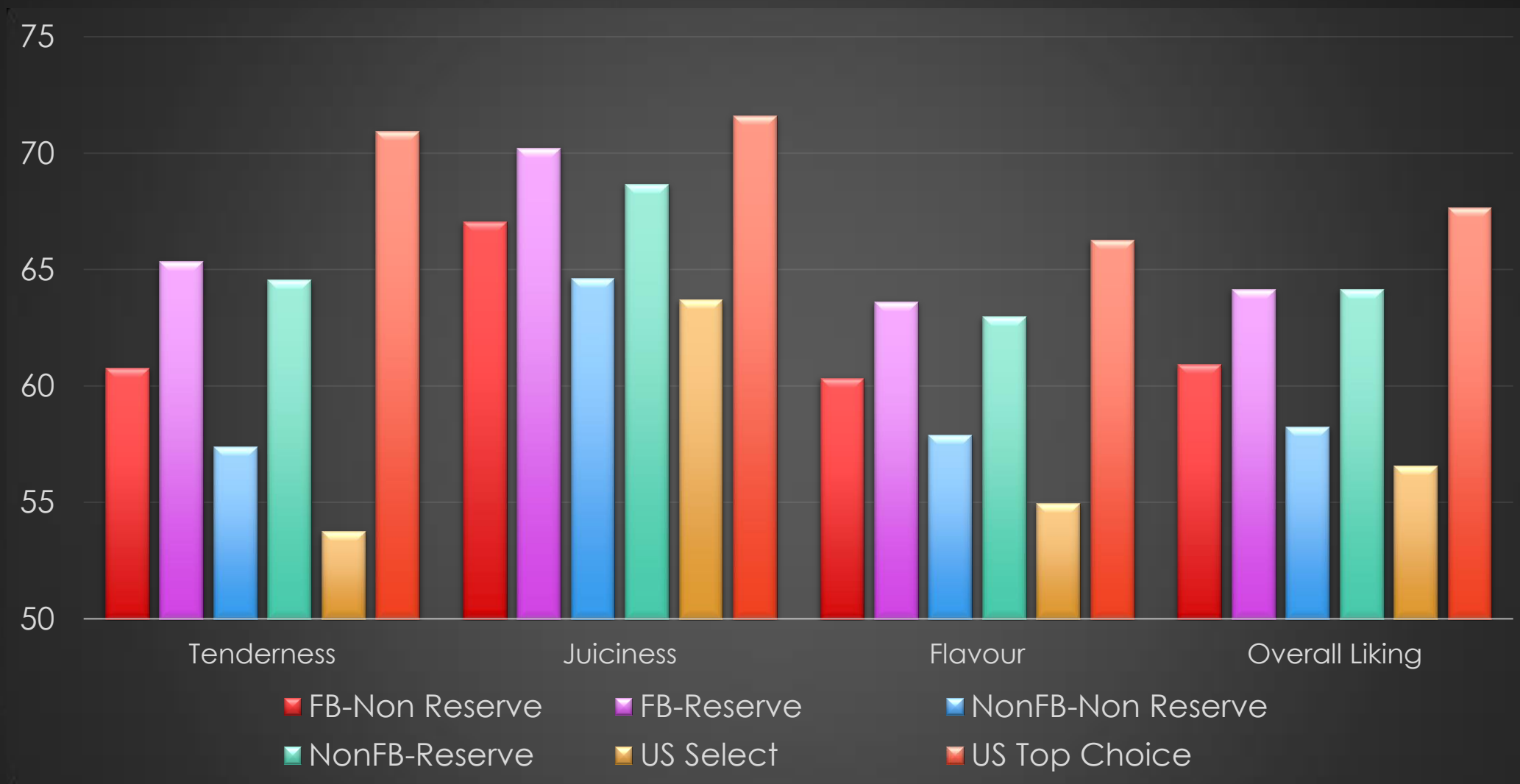
Please tick ☒ one of the following to rate the quality of the beef sample you have just eaten
Choose **one** only (you must make a choice).

- | | |
|------------------------------|--------------------------|
| Unsatisfactory | <input type="checkbox"/> |
| Good everyday quality | <input type="checkbox"/> |
| Better than everyday quality | <input type="checkbox"/> |
| Premium quality | <input type="checkbox"/> |

Carcass assessment

- ▶ 60 carcasses/treatment = 360 total
 - ▶ EQ grading inputs (NZ only)
 - ▶ USDA grading inputs (NZ and US)
 - ▶ Marbling
 - ▶ Skeletal maturity (ossification on scale of 100-590)
 - ▶ Lean maturity (meat color on scale of 100-590)

Consumer Taste Testing Results



New Zealand carcass chilling trial

- ▶ 5 muscles from 40 carcasses utilized
 - ▶ 1 side conventionally chilled; 1 side hot boned (fabricated same day as kill within 90 minutes)

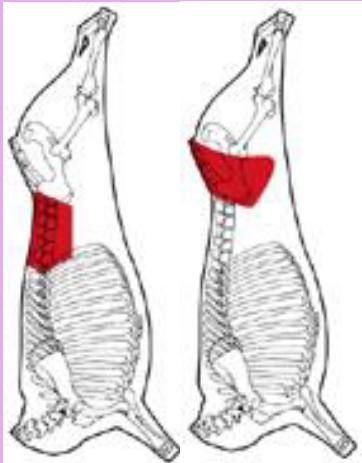
Testing at TTU – Fall, 2015

- ▶ Consumer testing (n = 1,200)

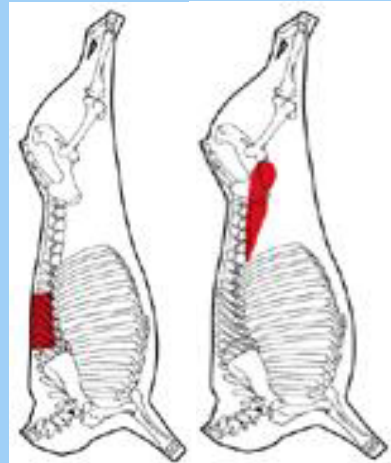
Advantage
Hot Bone



Similar eating quality



Advantage
Cold Bone



Effects of chilling and postmortem aging on consumer evaluation of tenderness, juiciness, flavor, and overall liking of five beef muscles					
	Treatment		Aging		
	Cold boning	Hot boning	7	21	35
Tenderness					
LT	69.10	63.14	62.45 ^b	66.67 ^a	69.25 ^a
GM	59.85	57.86	56.56 ^b	58.83 ^{ab}	61.17 ^a
LL	65.28	66.12	60.89 ^c	66.14 ^b	70.06 ^a
PM	81.15	71.88	74.94	77.70	76.91
SM	34.54	39.25	31.96 ^b	37.86 ^a	40.86 ^a
Juiciness					
LT	67.94	63.61	65.31	64.59	67.43
GM	57.67	59.50	57.39	57.54	60.83
LL	65.90	65.16	62.08 ^b	64.96 ^b	69.55 ^a
PM	69.65	66.85	67.24	68.62	68.89
SM	42.34	46.05	40.07 ^b	45.69 ^a	46.83 ^a
Flavor					
LT	61.63	59.66	59.02	60.27	62.65
GM	57.32	57.37	56.54 ^a	56.28 ^a	59.20 ^a
LL	61.52	61.58	58.18 ^c	61.41 ^b	65.06 ^a
PM	68.97	64.09	66.09 ^a	66.99 ^a	66.52 ^a
SM	43.67	47.46	42.80 ^b	46.98 ^a	46.91 ^a
Overall Liking					
LT	64.78	61.50	61.26 ^b	62.52 ^{ab}	65.63 ^a
GM	57.50	57.40	55.97 ^b	56.10 ^b	60.29 ^a
LL	62.64	63.56	59.41 ^c	62.93 ^b	66.96 ^a
PM	72.39	66.69	69.35	69.95	69.32
SM	40.81	45.09	38.72 ^b	45.31 ^a	44.83 ^a

¹LT- *longissimus thoracis*; GM - *gluteus medius*; LL - *longissimus lumborum*; PM - *psoas major*; SM - *semimembranosus*.
^{a-c} Within a row, least squares means without a common superscript differ ($P<0.05$) due to aging.

Honduran based testing

- ▶ Carcass grading
 - ▶ USDA assessment
- ▶ Consumer testing
 - ▶ Eating quality of beef derived from various finishing systems
 - ▶ Grazing vs. grain fed
 - ▶ Comparison of multiple systems utilizing available local feedstuffs to improve live animal performance
 - ▶ Enhancement
 - ▶ Depending on the trial, typically mirror trials in Honduras and US




2016 Honduran beef consumer study

- ▶ 288 total consumers
- ▶ Collected paired strip loins from various diets formulated for feeding trials
- ▶ One side enhanced (water, salt and phosphate to 12%); one side non-enhanced


PRODUCTO :

Suavidad

Muy Duro  Bien Suave


Fue aceptable la **SUAVIDAD** de esta muestra: si ☐ no ☐

Jugosidad

Muy Seco  Bien Jugoso

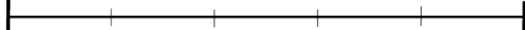
Fue aceptable la **JUGOSIDAD** de esta muestra: si ☐ no ☐

Sabor

Me disgusta Extremadamente  Me gusta Extremadamente

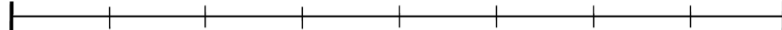
Fue aceptable el **SABOR** de esta muestra: si ☐ no ☐

Aceptación General

Me disgusta Extremadamente  Me gusta Extremadamente

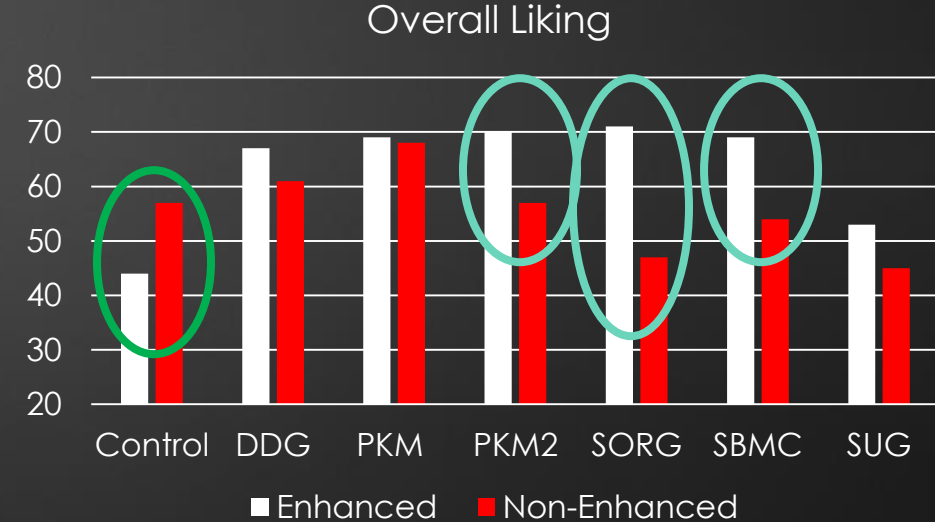
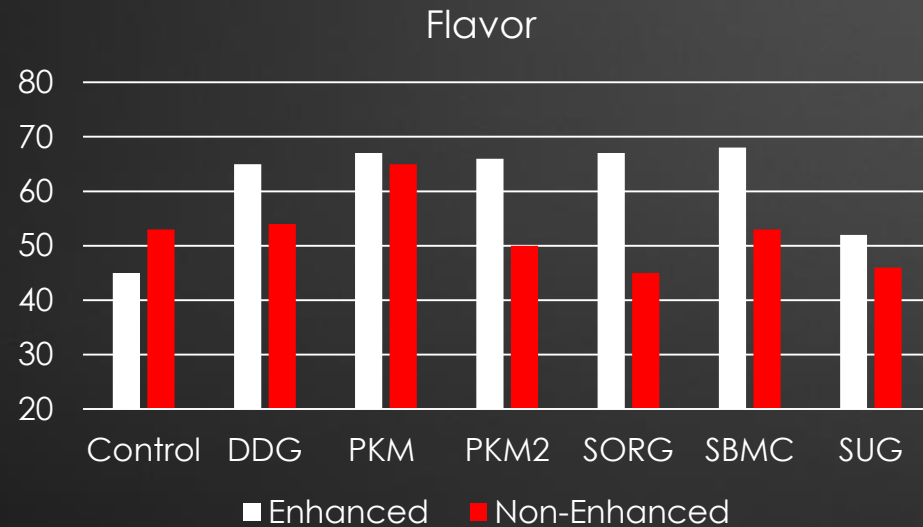
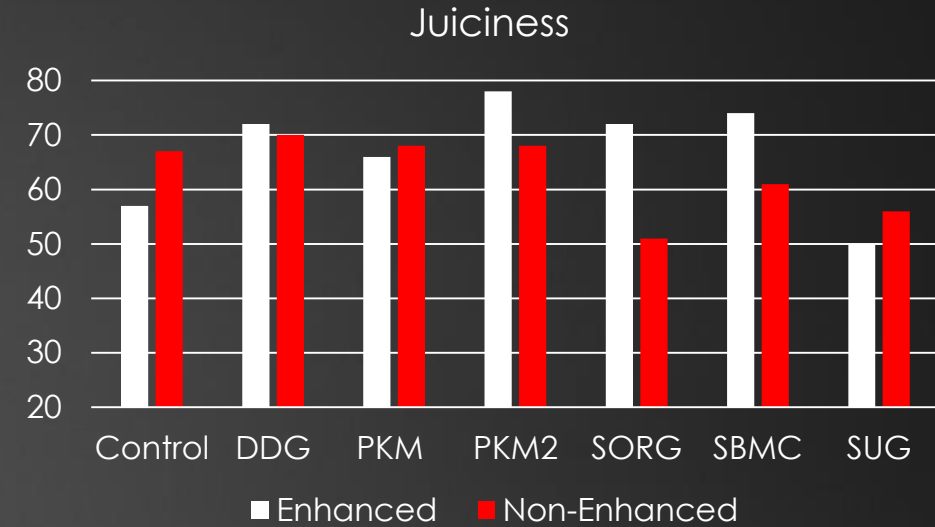
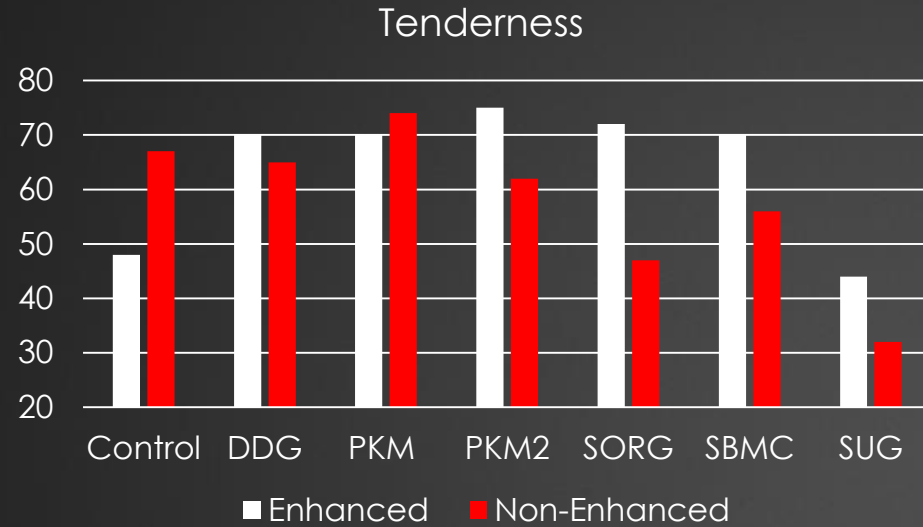
Fue aceptable en **GENERAL** esta muestra: si ☐ no ☐

Basado en la muestra que usted acaba de consumir: Favor marcar en la línea donde indique cuanto usted estaría dispuesto a pagar en el supermercado por esta muestra.



L.0/lb L.100/lb L.200/lb L.300/lb L.400/lb L.500/lb L.600/lb L.700/lb L.800/lb

Preliminary results

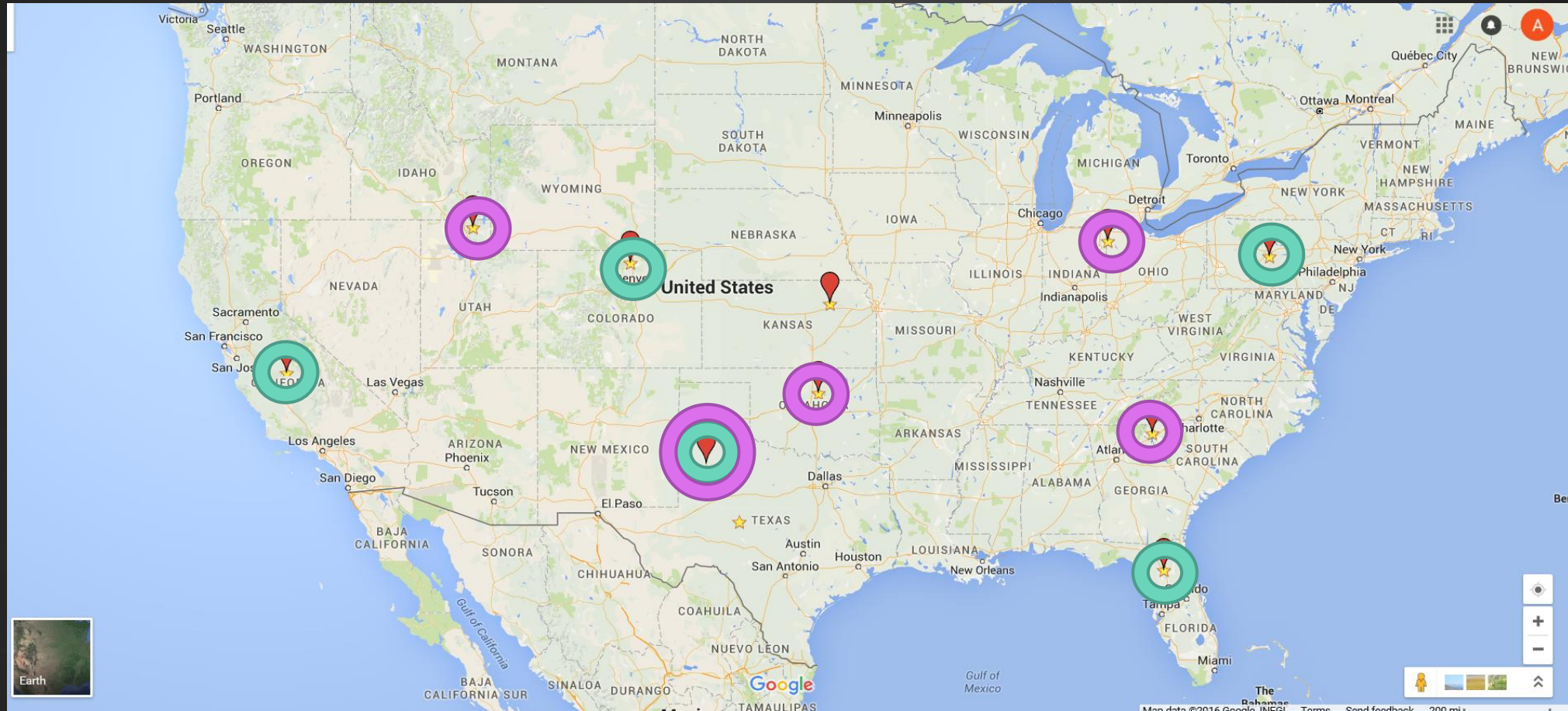


Country	Carcass Grading System	Meat COO	Species	Year	Consumer Testing	Ballot format
Australia	USDA/MSA	AUS US	Beef	2005		MSA
Wales	MSA	Wales	Beef	2010	Wales	MSA
Poland	MSA	Poland	Beef	2010-2015	Poland	MSA
New Zealand	Initial USDA Final EQ (MSA) US product – USDA	NZ US	Beef	2012-present	NZ US	MSA
Honduras	USDA	US Hondur as	Beef	2013-present	US Honduras	TTU

International Lamb Consumer Work

USA nationwide lamb consumer study

- 720 consumers total (360 per experiment)
 - Low, Medium, & High Marbling US loins aged 21 or 42 d
 - Legs & Loins from New Zealand, Australia, and the US



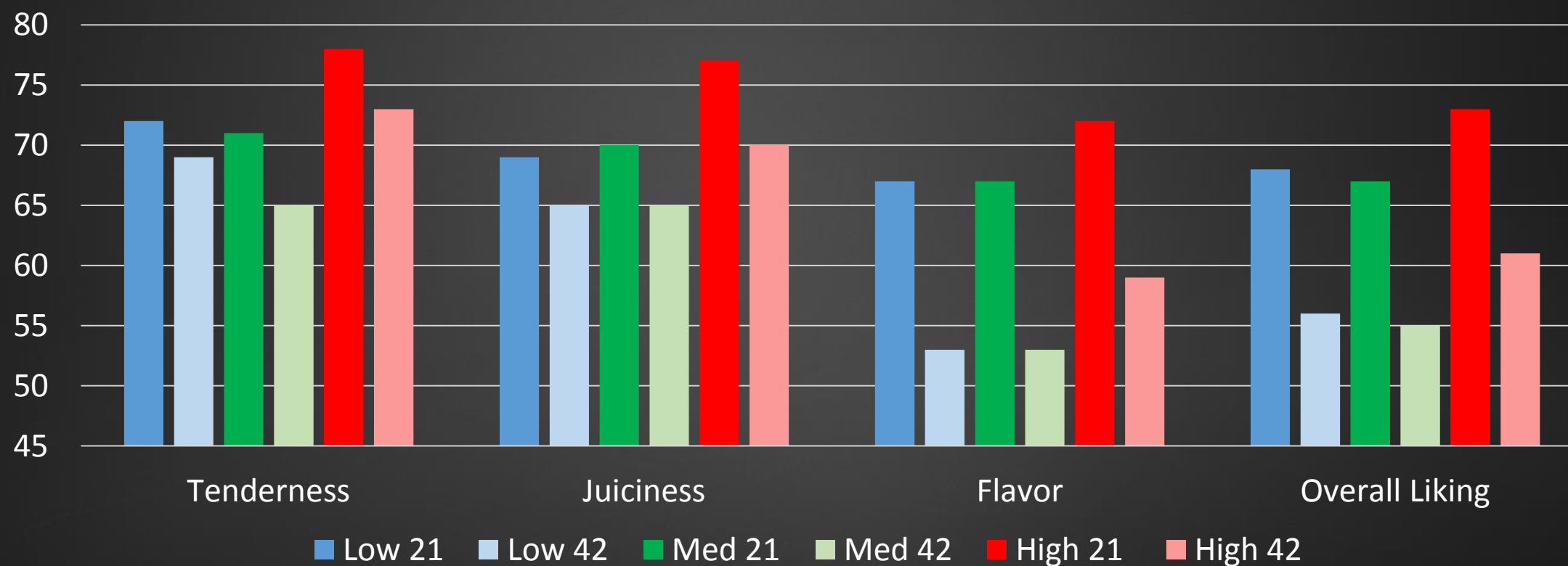
Multi-country
testing



US marbling x aging loin
testing

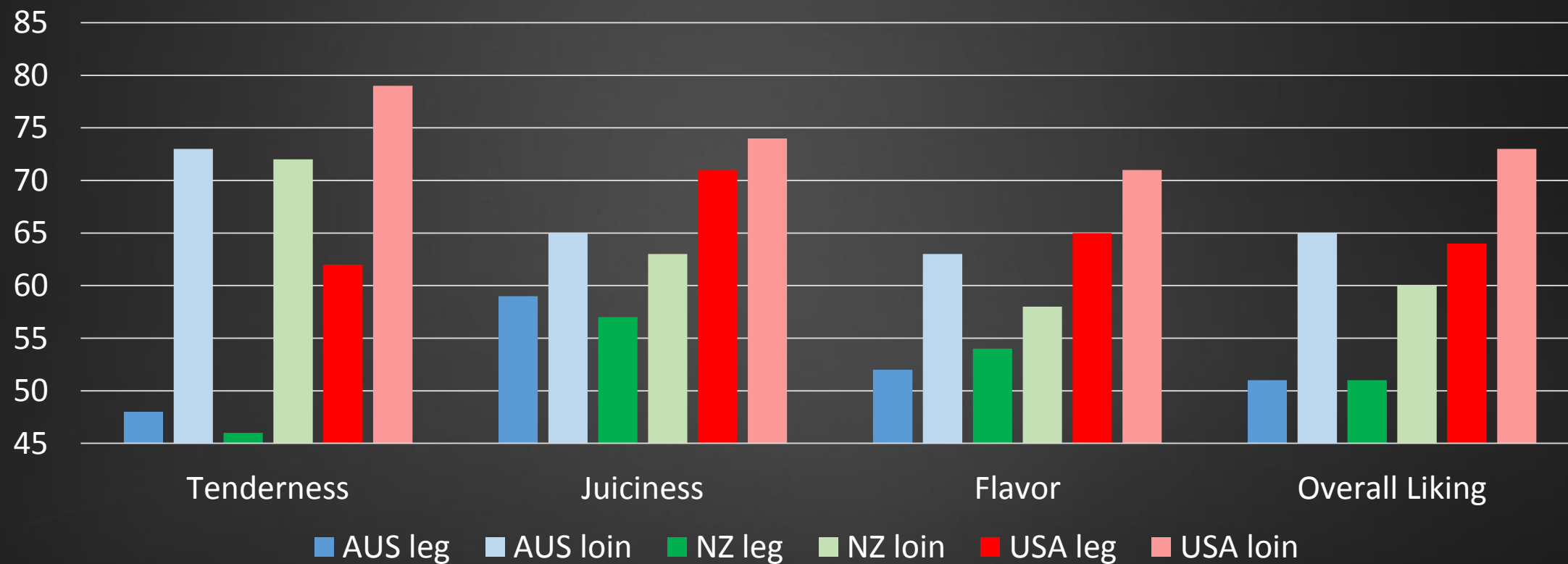
US loin results

Comparing eating quality traits of US lamb from different marbling levels



Multi-country results

Comparing eating quality traits of US, Australian, and New Zealand lamb



New Zealand lamb trial

- ▶ Phase 1
 - ▶ Collected carcass data from ~500 late season lambs (May, 2015)
 - ▶ Data not involved in trial design; only provided to SFF/AgResearch to include with other data
 - ▶ Flank streaking
 - ▶ Flank color
 - ▶ Skeletal Maturity
 - ▶ Conformation Score
 - ▶ Consumer testing based in Otago NZ (n = 360 consumers)
 - ▶ Loin and rump collected from 108 carcasses



Phase 2 selection

- ▶ Gender (wether, ram, cryptorchid, ewe)
- ▶ Carcass weight brackets (light, mid, heavy)
- ▶ GR (<6, 6-9, 10+)
- ▶ Muscle (loin, rump, topside, knuckle)
- ▶ Aging (2, 7, 14, 28)
- ▶ pH [normal, high(er)]
- ▶ Attempt to select from all cooperating suppliers (within reason)
- ▶ Breed information and weight gain (30 d before slaughter) available – not factored into selection criteria



Consumer testing (US portion)



- ▶ Consumer testing
 - ▶ 24 picks (1,440 consumers)
 - ▶ Lubbock plus 4 other sites
 - ▶ Lubbock (480)
 - ▶ San Francisco, CA (240)
 - ▶ Denver/Fort Collins, CO (240)
 - ▶ Ohio (240)
 - ▶ Gainesville or Miami, FL (240)
- ▶ Objective samples (fat content)
 - ▶ Correlate eating quality to fat content

Country	Carcass Grading System	Meat COO	Species	Year	Consumer Testing	Ballot format
Australia	USDA/MSA	AUS US	Beef	2005		MSA
Wales	MSA	Wales	Beef	2010	Wales	MSA
Poland	MSA	Poland	Beef	2010-2015	Poland	MSA
New Zealand	Initial USDA Final EQ (MSA) US product – USDA	NZ US	Beef	2012-present	NZ US	MSA
Honduras	USDA	US Honduras	Beef	2013-present	US Honduras	TTU
New Zealand	Initial USDA/in-house Final TBD	NZ	Lamb	2015- present	NZ US	MSA
US	USDA (if possible) with modifications	US NZ AUS	Lamb	2016	US	TTU (MSA with modifications)
Australia		AUS	Lamb	2016	AUS US China	MSA