

Lamb Meat Quality

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April 25, 2017



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Lamb Meat Quality



ASI Let's Grow Webinar

Dr. Travis W. Hoffman

Extension Sheep Specialist

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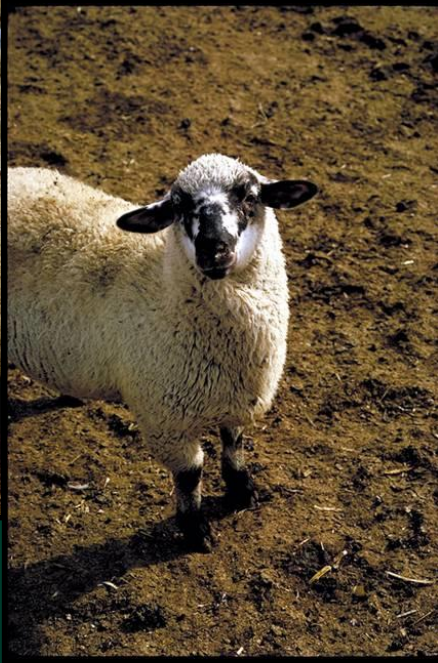
American Lamb

- Do we know our bullseye?
- How do we get there?
- Can we do it consistently?



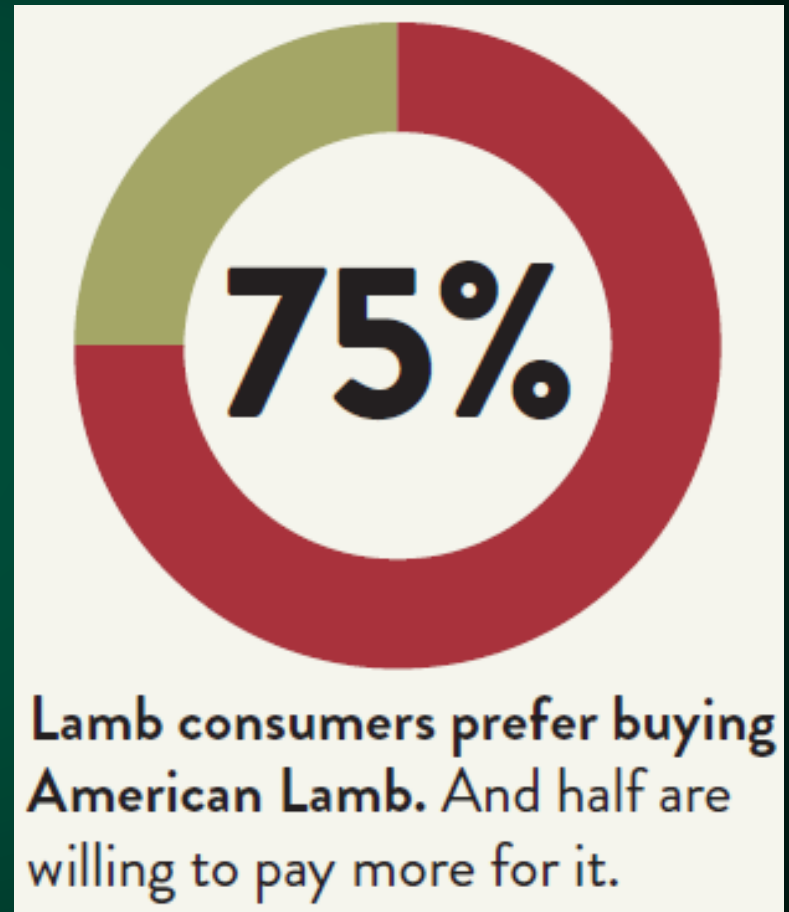
Beginning with the End
in Mind!

LAMB: The Trendy Protein



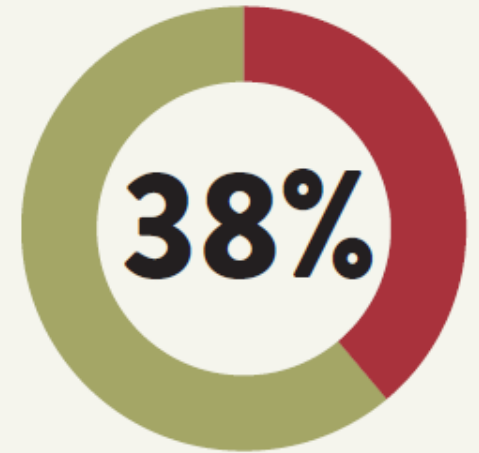
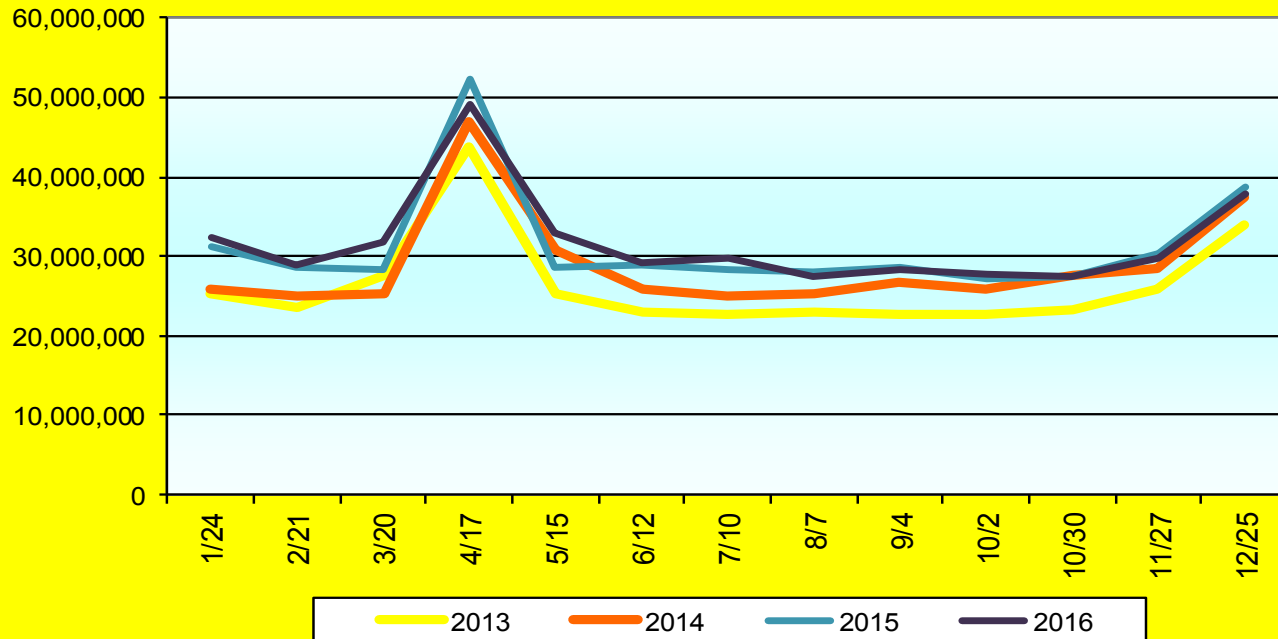
The American Lamb Consumer

- Roughly 40 percent of consumers have never eaten lamb
 - *many report they have never had the chance to try it*
- Males are more likely to be lamb eaters
- Income plays a role in lamb consumption
- Lamb consumption linked to special occasions



Total US Lamb Sales by Year

Lamb Dollars 2013-2016



Percent of households that buy lamb for home preparation each year. Millennials are pushing growth in the lamb category.

Consistent Lamb Dollars and Pounds of sales
Average Price: \$6.97/lb. (2016)

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Information Resources, Inc./Fresh Look Marketing, 2016

Lamb Retail Growth

In 2016, at retail:

Lamb \$: ↑ 1.5%

Lamb lbs: ↑ 3.7%

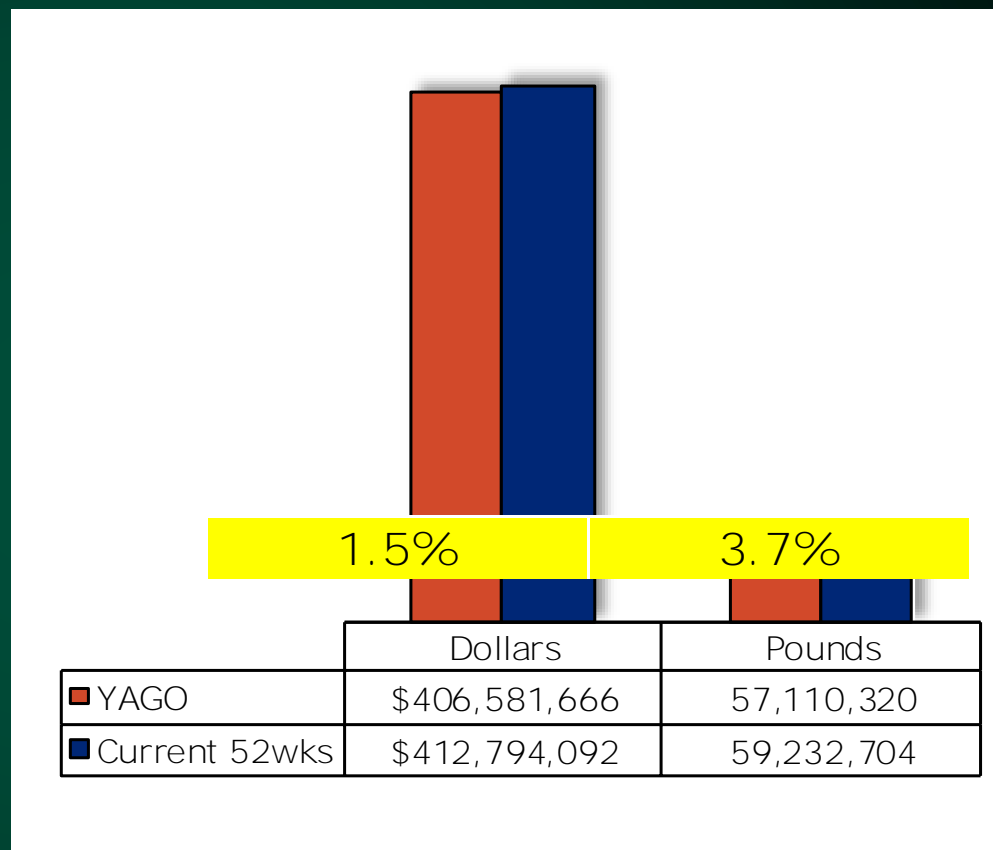
2017 Easter Special

Bone-in Leg: \$5.70/lb.

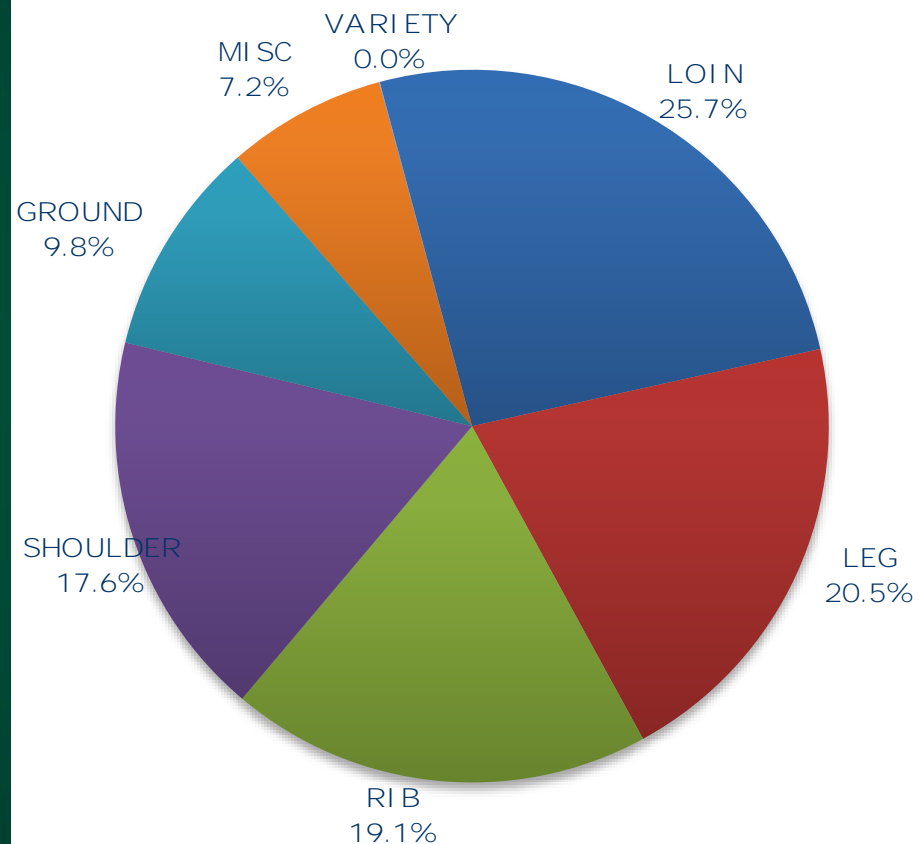
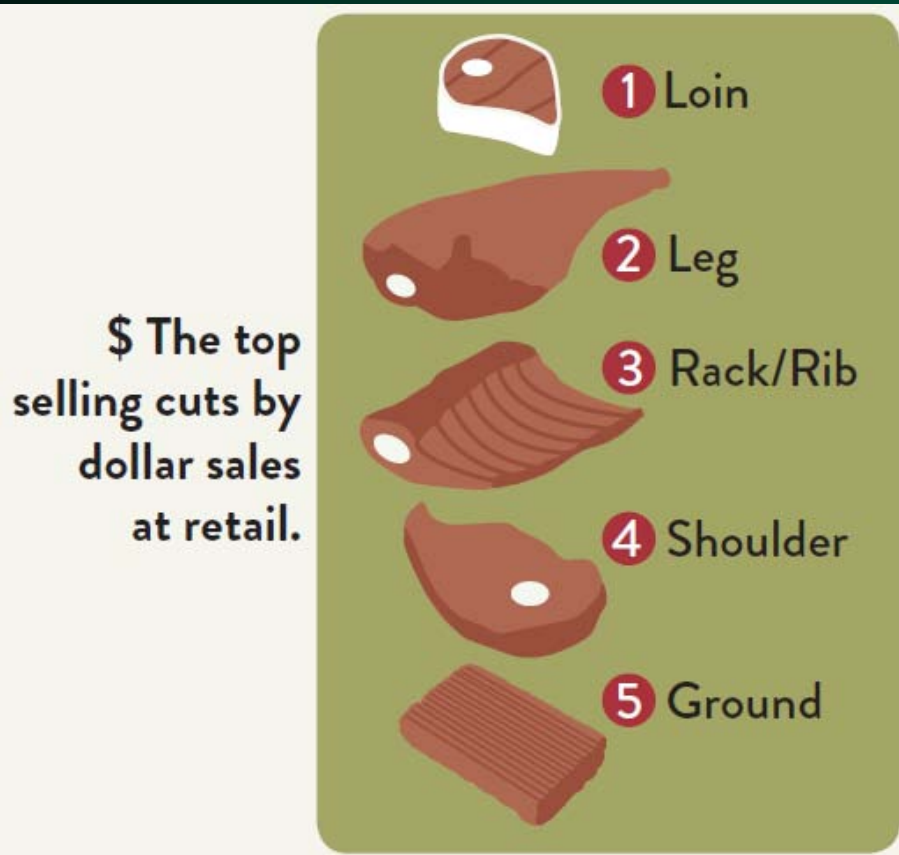
Rack: \$10.85/lb.

Loin Chops: \$7.82/lb.

Shoulder Chops: \$4.98/lb.



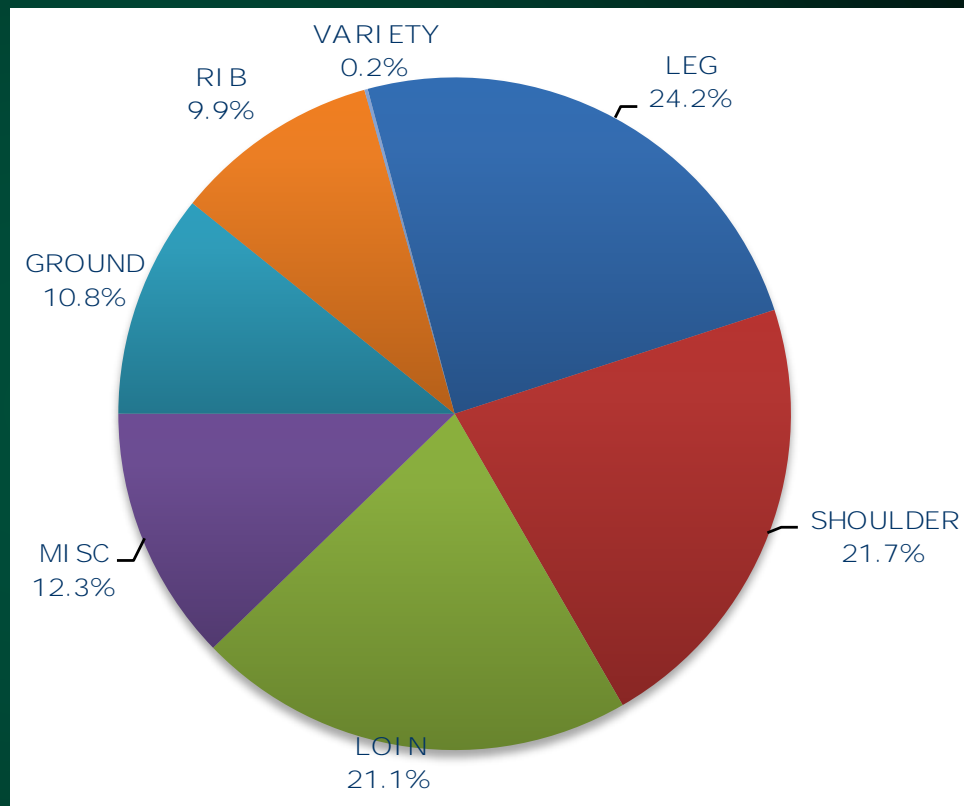
Lamb retail: % of \$ per primal



Lamb Retail: % of lbs. sold

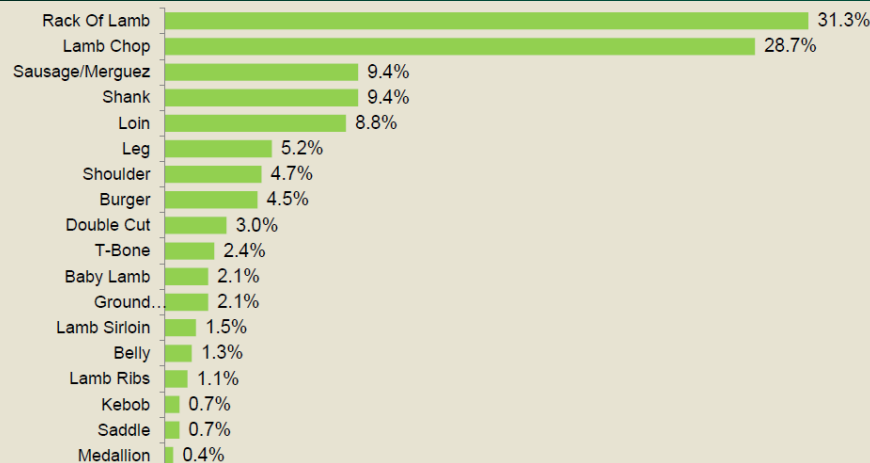
Preferred cuts:

- Northeast = Leg
- Southeast = Shoulder
- California = Shoulder
- Mid-South = Shoulder
- West = Loin
- Great Lakes = Leg
- South Central = Leg
- Plains = Leg



Top 10 Restaurant Trends in 2017

- 1) Hyper-local sourcing (e.g. restaurant gardens)
- 2) Chef-driven fast-casual concepts
- 3) **Natural ingredients/clean menus**
- 4) **Environmental sustainability**
- 5) Locally sourced produce
- 6) **Locally sourced meat and seafood**



Source: Lamb Menu Study for the American Lamb Board - MenuTrends Datassential 2016



Ethnic Marketing



Ethnic Cuisine

American consumers
are adventurous:

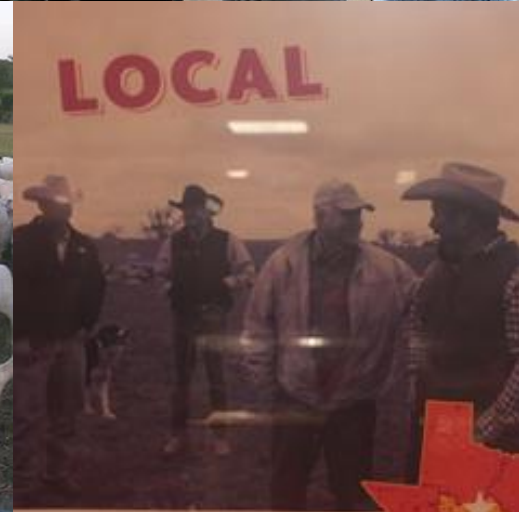
- Mediterranean
- Spanish
- Caribbean
- Middle Eastern
- French
- Thai



Non-Traditional Market

PRODUCERS

LIVESTOCK AUCTION COMPANY



What is Lamb?

- 1) Young Sheep (32%)
- 2) Red Meat Alternative (25%)
- 3) Delicious and Flavorful Attributes (20%)
- 4) Delicacy, High End Meat (9%)
- 5) Healthy Protein (7%)
- 6) Other (6%)





Retail: Supermarket (n = 31); Butchers (n = 11); Direct/Farmer's Market (n = 18)



Foodservice: Fine Dining (n = 23); Casual Dining (n = 22); Purveyors (n = 15)







14 Does American Lamb = Quality?

Are we winning at retail and foodservice?

“You cannot manage, what you don’t measure.”



Defining Lamb Quality

“What are the quality traits (buckets) that drive purchasing decisions at retail/foodservice/purveyor sectors?”

- ❖ Origin
- ❖ Sheep Raising Practices
- ❖ Eating Satisfaction
- ❖ Weight/Size
- ❖ Product Appearance/Composition
- ❖ Product Convenience/Form
- ❖ Nutrition/Wholesomeness



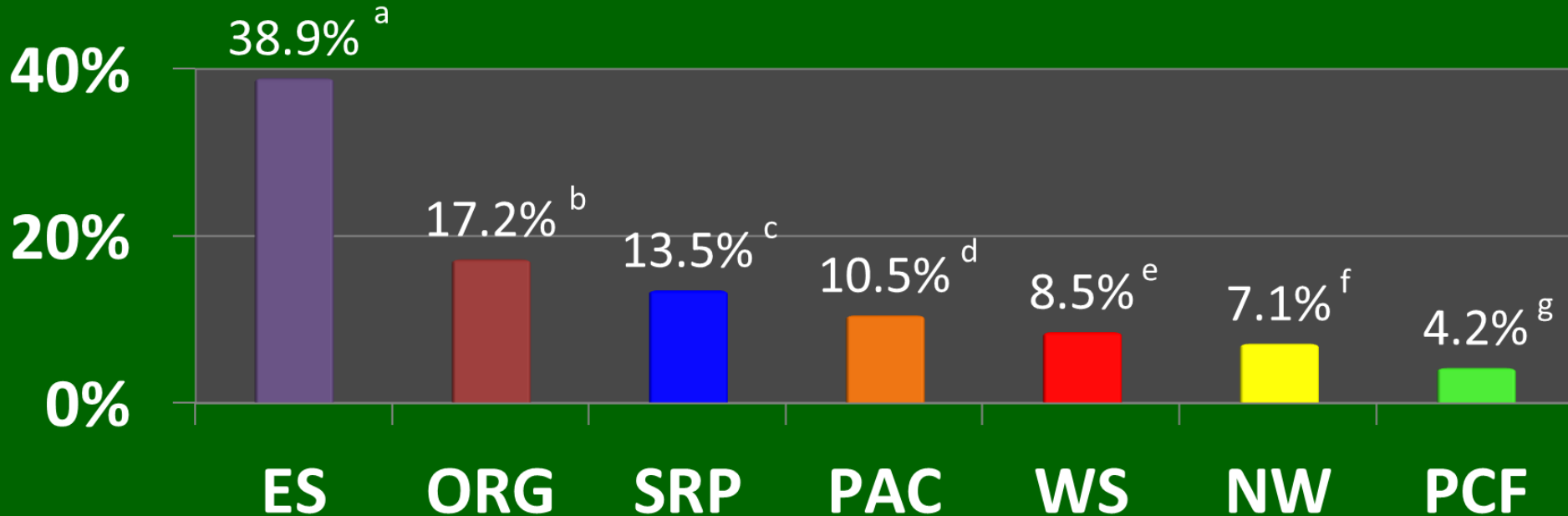
Primary & Secondary Quality Definitions

| Quality Attribute | Primary Definition | Secondary Definition |
|--|------------------------|--------------------------|
| Eating Satisfaction (ES) | 1) Lamb Flavor/Taste | 2) Tenderness |
| Origin (ORG) | 1) Locally Raised | 2) American |
| Sheep Raising Practices (SRP) | 1) Grass-Fed | 2) Humanely Raised |
| Product Appearance/ Composition (PAC) | 1) Lean to Fat Ratio | 2) Fresh Lamb Color |
| Weight/Size (WS) | 1) Consistent Cut Size | 2) Consistent Cut Weight |
| Nutrition/Wholesomeness (NW) | 1) Healthy | 2) Lean |
| Product Convenience/Form (PCF) | 1) Availability | 2) Cut Specifications |

Shares of Preference Results

17

Lamb Quality Attribute Shares of Preference



Percentages lacking a common superscript differ ($P < 0.05$).

Rank and shares of preference (%) for seven quality attributes identified by interview respondents (N = 120) representing retail, foodservice, and purveyor sectors.

Willingness-to-Pay probability for requirement, no premium, willing to pay a premium for seven quality attributes, and average WTP Premium.



| WTP | ORG | SRP | ES | WS | PAC | PCF | NW |
|--------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Requirement | 25.83% | 20.00% | 9.17% | 13.33% | 9.17% | 5.83% | 1.67% |
| No Premium | 22.50% | 27.50% | 19.17% | 52.50% | 38.33% | 55.83% | 50.83% |
| Willing to Pay a Premium | 51.67% | 52.50% | 71.67% | 34.17% | 52.50% | 38.33% | 47.50% |
| Average WTP Premium | 14.17% (n = 62) | 14.17% (n = 63) | 18.59% (n = 86) | 13.82% (n = 41) | 14.88% (n = 63) | 12.66% (n = 46) | 13.64% (n = 57) |



Why do people purchase lamb?

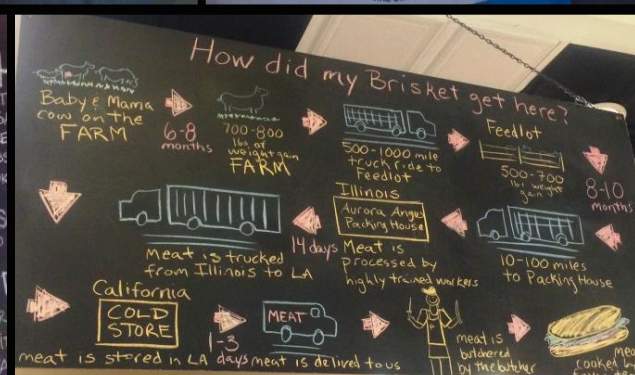
delicious
different
history
love
ness
unique
flavor
taste
tradition
hungry
ethnic
trendy





Lamb Flavor = Quality Eating Experience





Connection with Farmer/Rancher



A large flock of sheep is grazing in a lush green field. In the background, there is a dense forest of evergreen trees, and further back, a range of rugged mountains with patches of snow under a clear blue sky. The text "Embrace the Pastoral Image & Environmental Stewardship of Lamb" is overlaid in the center of the image.

Embrace the Pastoral Image & Environmental Stewardship of Lamb

Country of Origin

- Lamb has greater import competition than other competing red meat proteins.
- Do retailers/foodservice/purveyors place an emphasis on country of origin prior to purchasing lamb?

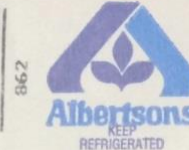


Born, Hatched, and Harvested?



LAMB SHOULDER BLADE CHOPS

BORN, HATCHED, AND HARVESTED IN THE U.S.





LAMB SHOULDER BLADE CHOPS


BORN, HATCHED, AND HARVESTED IN THE U.S.

SAFE HANDLING INSTRUCTIONS

THIS PRODUCT WAS PREPARED FROM INSPECTED AND PASSED MEAT AND/OR POULTRY. SOME FOOD PRODUCTS MAY CONTAIN BACTERIA THAT COULD CAUSE ILLNESS IF THE PRODUCT IS MISHANDLED OR COOKED IMPROPERLY. FOR YOUR PROTECTION, FOLLOW THESE SAFE HANDLING INSTRUCTIONS.

 KEEP REFRIGERATED OR FROZEN. THAW IN REFRIGERATOR OR MICROWAVE.

 COOK THOROUGHLY.
KEEP RAW MEAT AND POULTRY SEPARATE FROM OTHER FOODS.
WASH WORKING SURFACES (INCLUDING CUTTING BOARDS), UTENSILS, AND HANDS AFTER TOUCHING RAW MEAT OR POULTRY.

 KEEP HOT FOODS HOT. REFRIGERATE LEFT-OVERS IMMEDIATELY OR DISCARD.

Tare
0.03 lb

Net Wt/Ct
0.87 lb

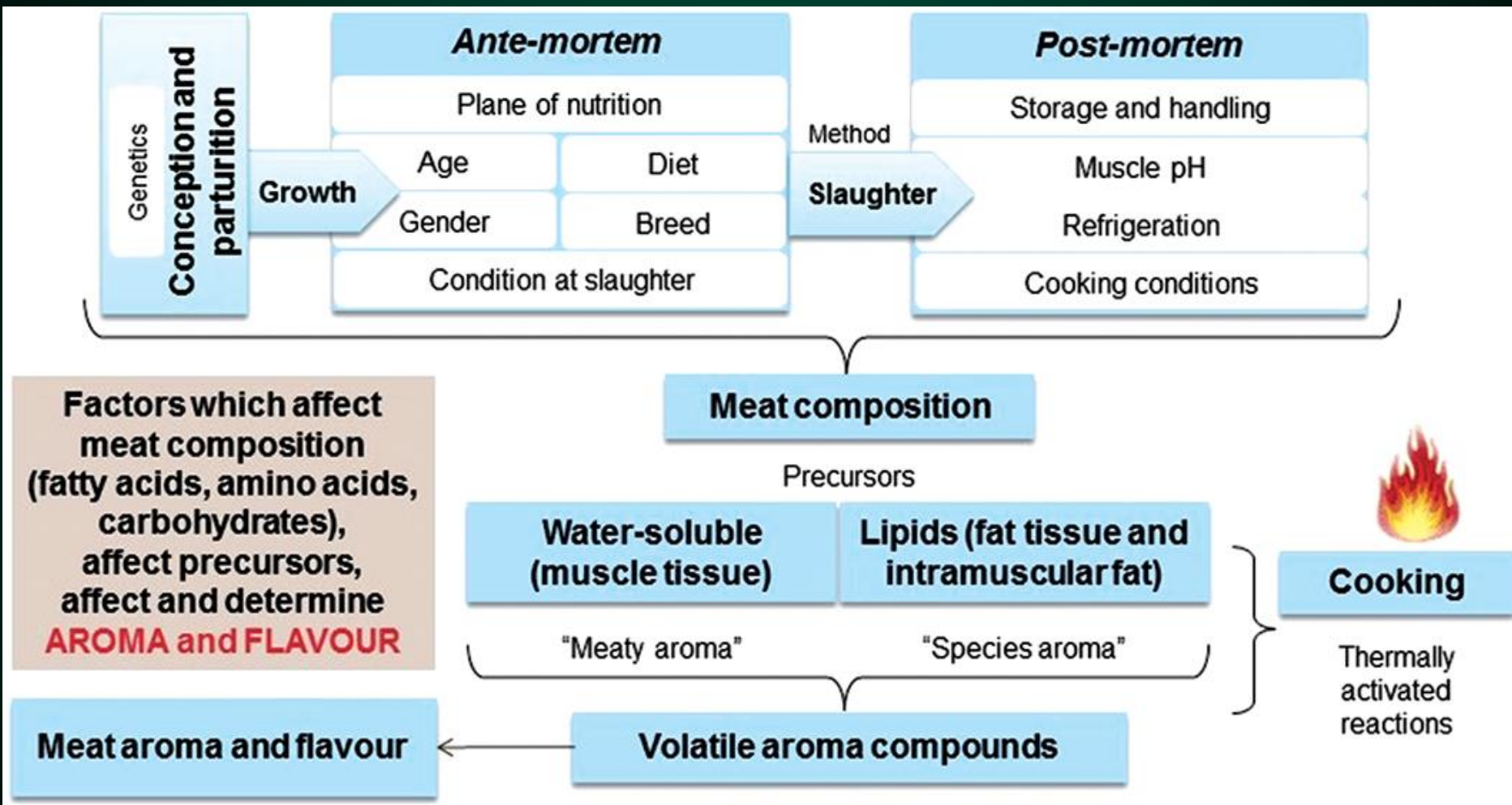
Unit Price
\$7.49/lb

Sell By
Mar 24, 15

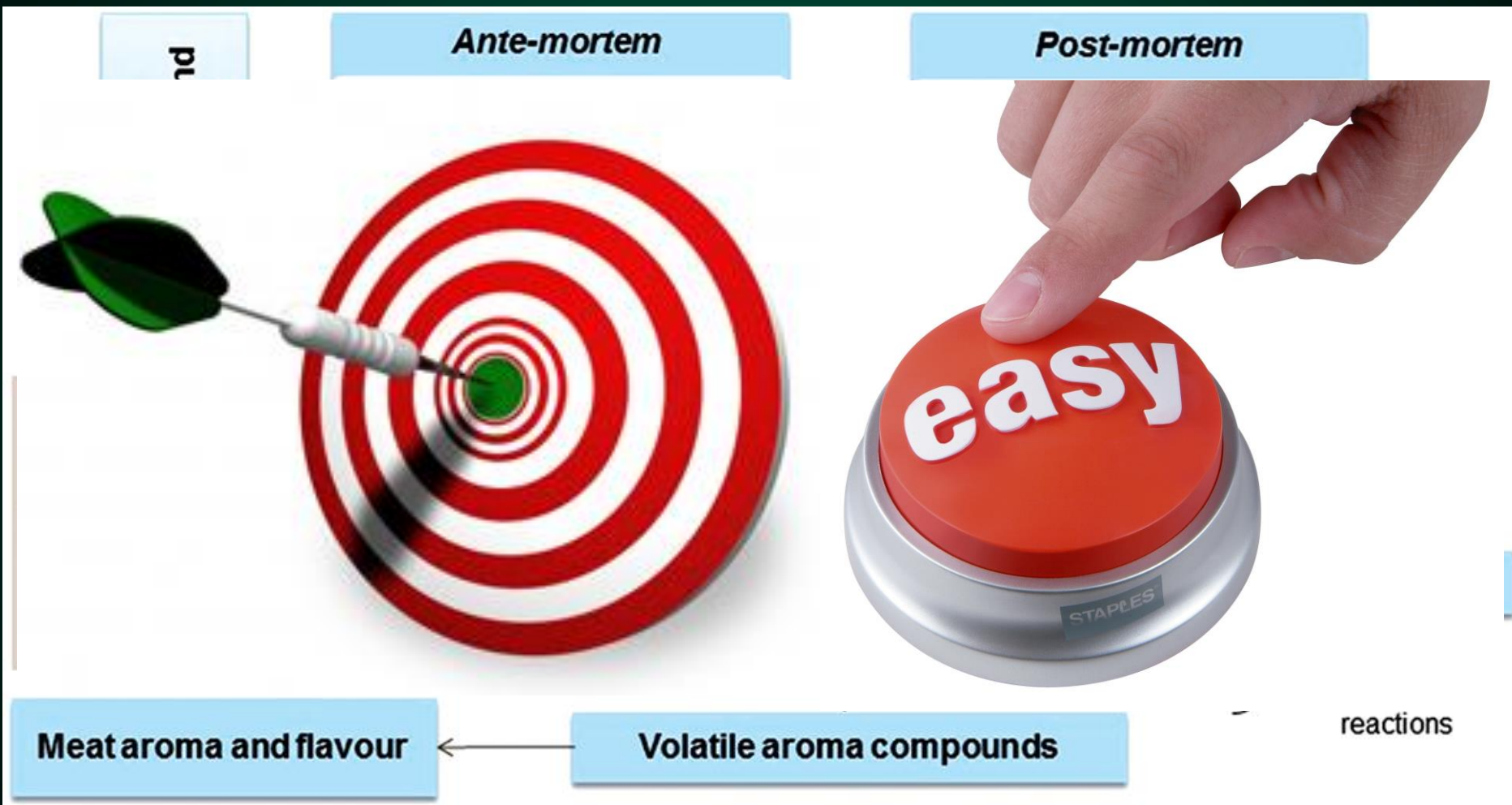
Total Price
\$6.52

Albertson's

Lamb End Product Quality



Lamb End Product Quality



Product Uniformity

If only we could make lambs with big racks and loins, small shoulders and legs? Lamb suits many retail/foodservice markets with a variety of cuts.



Product Uniformity



Age Determination for Lamb

65% of respondents request young lamb;
most commonly described as under one year of age as lamb.

“People would rather pay a little more money than buy a bad-flavored, gamey lamb.”

“Absolutely, young lamb is necessary. I tend to gravitate to smaller, younger lambs because I think the flavor is so much better. There is no gamey flavor in young lamb. If bigger lamb tasted that good, I would buy them, but they don't. From a retail standpoint they probably don't look as big, so I understand.”

“The lambs need to be under one year of age. We need to clearly define what lamb is in the U.S.A.”

USDA Grading

USDA Yield Grade:

YG1: 6.01%

YG 2: 32.71%

YG 3: 31.56%

YG 4: 15.43%

YG 5: 14.28%

USDA Quality Grade:

Prime 7.6%

Choice: 92.4%



USDA Yield/Quality Grade

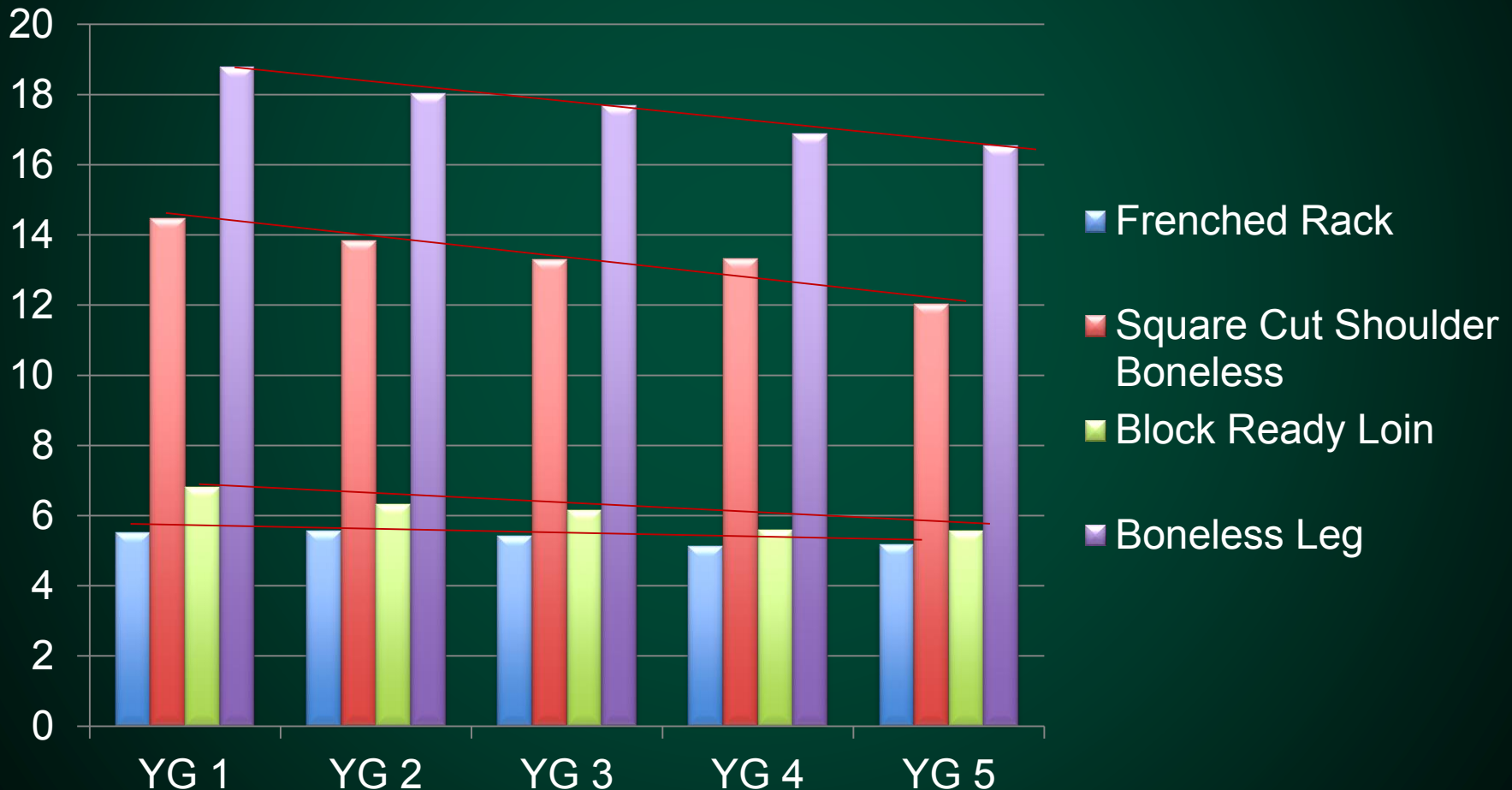
Are USDA Yield and Quality Grade standards and application currently meeting the needs of the industry?

USDA Yield Grade: 8.3% of Retailers
USDA Quality Grade: 33.3% of Retailers



Lamb Primal Yield by USDA YG

Subprimal Yield of Cuts Expressed as % of Cold Carcass Weight

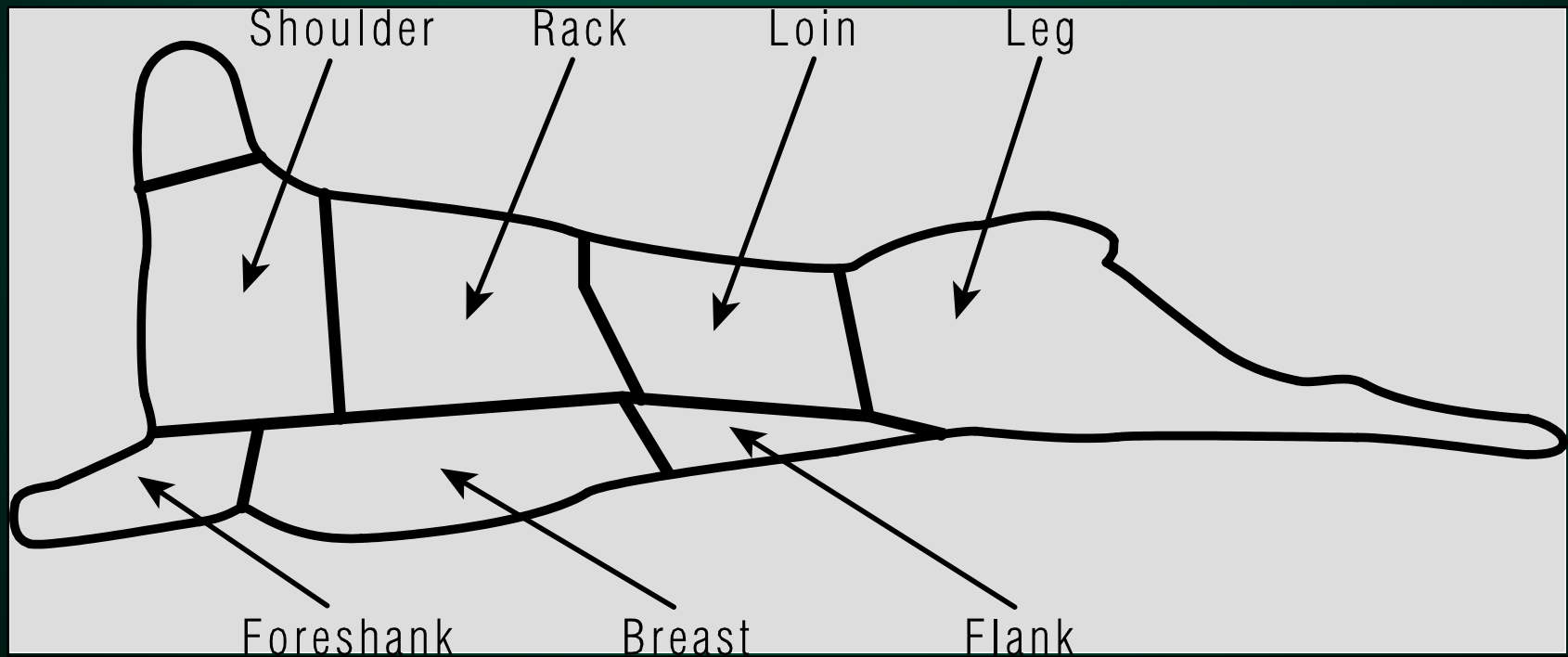


Lamb Primal / Subprimal Cuts

\$3.14 / lb * 70 lb carcass weight = \$219.80

(USDA, April 21, 2017)

\$2.92 \$7.47 \$5.32 \$3.65

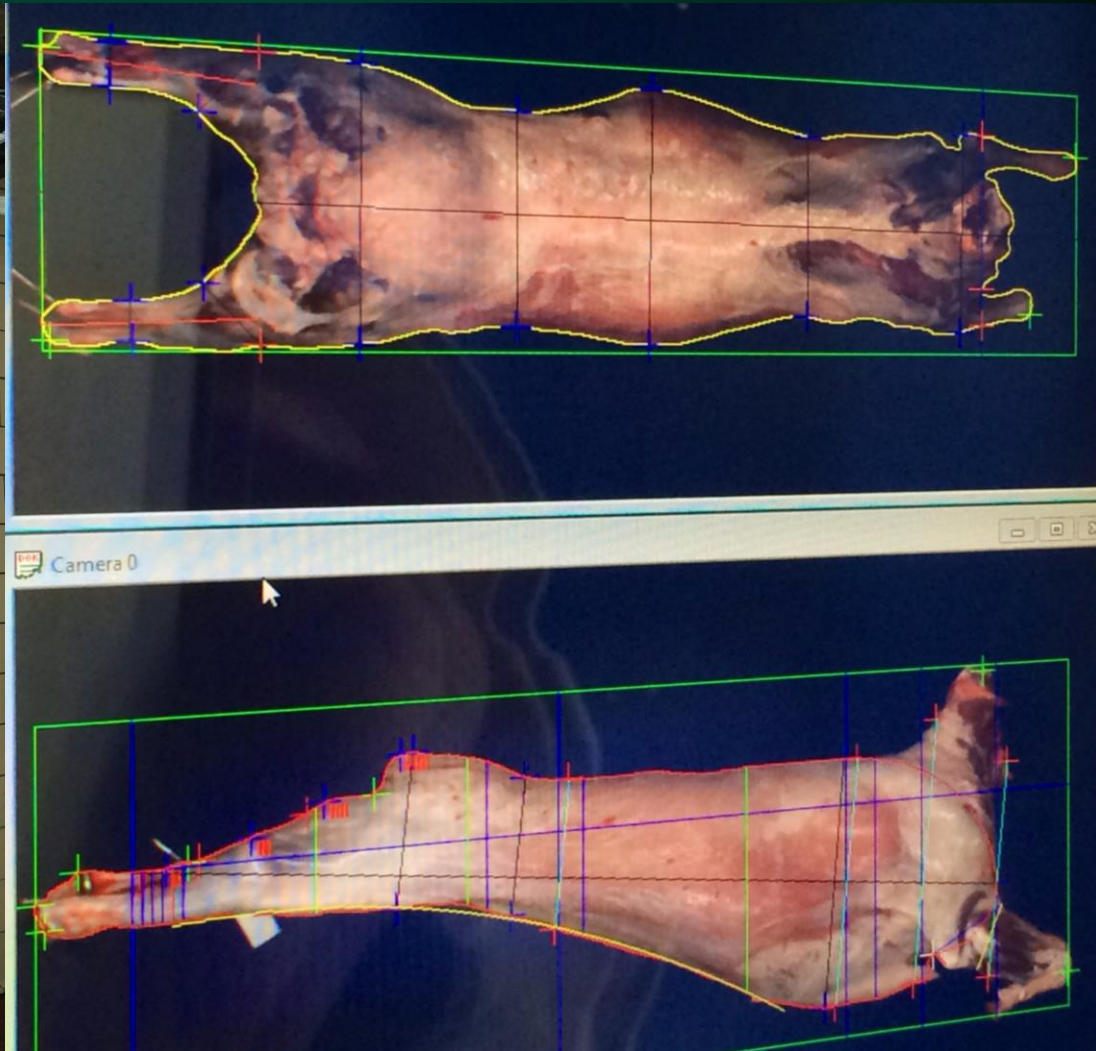


\$3.75


\$1.38

\$1.46

Lamb Instrument Grading




Information Transfer



Superior Farms
AMERICAN LAMB

Producer Portal
Lot Detail Report


Home Reports Information & Downloads



Individual Carcass Data

[<Previous](#) [Return To Lot Detail](#) [Next>](#)

| | | | |
|-----------------------|-------------|---------------------|--------|
| Harvest Date: | 1/14/2016 | Quality Grade: | 289.6 |
| RFID: | 17597020571 | Confidence: | 331 |
| Lot Number: | 101 | Final Grade: | 310 |
| Serial Number: | 3 | Class: | Choice |
| Hot Weight: | 63.1 | OCC: | 42.3 |
| Species: | Lamb | Breast Lbs: | 4.6 |
| Yield Grade: | 3.85 | Rack Lbs: | 7.4 |
| Cold Weight: | 62.6 | Should Sq. Cut Lbs: | 9.6 |
| Shrink Lbs: | 0.5 | Leg Lbs: | 20 |
| Shrink % : | 0.79% | Loin Lbs: | 5.2 |
| Cold Weight Date: | 1/15/2016 | Neck Lbs: | 2.1 |
| Cold Weight Location: | Fab Scale | Trotter Lbs: | 0.7 |

Harvest Date: Lot #:  Serial #:

Lamb Cutability



Lamb Fabrication

Is the lamb industry “improving quality with the knife?”

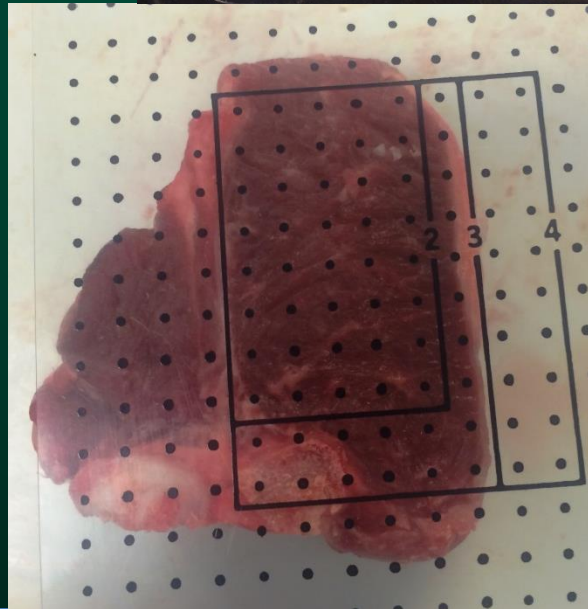
How can we continue to meet consumer specifications and enhance lamb demand?



The Cost of Fat



Lamb Product Dimensions

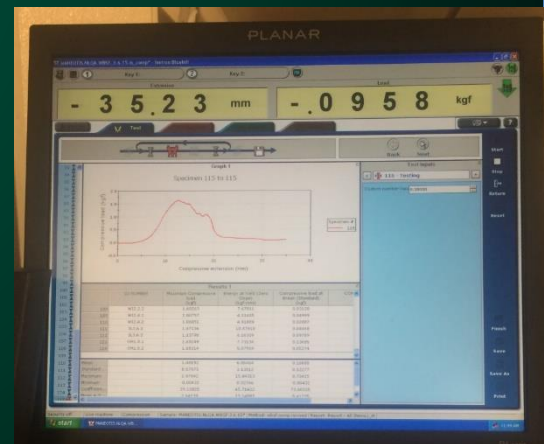


Lamb Loin Dimensions at Retail

| Trait | U.S. (n = 383) | Australia (n = 67) | New Zealand (n =115) | P - Value |
|---------------------------------|-------------------------|-------------------------|-------------------------|-----------------------------------|
| <i>Longissimus Dorsi</i> Area | 3.03^a | 2.60^b | 2.25^c | $P < 0.0001$ |
| <i>Psoas Major</i> Area | 1.11 | 0.91 | 0.96 | $P = 0.1839$ |
| Total Area | 7.88^a | 6.41^b | 6.15^b | $P < 0.0001$ |
| <i>Longissimus Dorsi</i> Width | 1.29 | 1.17 | 1.18 | $P < 0.0001$ |
| <i>Longissimus Dorsi</i> Length | 2.57^a | 2.43^b | 2.18^c | $P < 0.0001$ |
| Fat – 0% Location | 0.26^b | 0.25^b | 0.31^a | $P = 0.0137$ |
| Fat – 50% Location | 0.33^a | 0.25^b | 0.34^a | $P = 0.0027$ |
| Fat – 100% Location | 0.30^a | 0.23^b | 0.34^a | $P = 0.0122$ |
| Tail Length | 0.36^a | 0.18^c | 0.29^b | $P < 0.0001$ |



Tenderness Evaluation



Tenderness (Warner-Bratzler Shear Force)

| Lamb Cut WBSF | | | | P - Value |
|------------------|-----------------------------------|------------------------------------|-----------------------------------|-------------------|
| | U.S. (n = 71) | Australia (n = 13) | New Zealand (n = 22) | |
| Rib Chop | 1.90^a (0.06) | 1.52^b (0.015) | 1.57^b (0.12) | P = 0.0091 |
| | | | | |
| | U.S. (n = 191) | Australia (n = 34) | New Zealand (n = 56) | |
| Loin Chop | 1.78^a (0.03) | 1.51^b (0.08) | 1.56^b (0.06) | P = 0.0003 |
| | | | | |
| | Grass-Fed (n = 125) | Grain-Fed (n = 294) | | |
| Loin Chop | 1.80 (0.04) | 1.74 (0.03) | | P = 0.2126 |





Vision for the future!

Solve the Challenge

Lean Meat Yield / Eating Satisfaction / Producer Profitability



Making Magic Happen!



Wool Breeds



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Meat Breeds



Hair Breeds



ND, SD, & MN Gate to Rail



Gate to Rail Data

| Carcass Wt. | # of Head | HCW | FT | BW | REA | % BCTRC |
|----------------|--------------|--------------|-------------|-------------|-------------|--------------|
| >86 | 14 | 91.31 | 0.42 | 1.16 | 2.52 | 42.47 |
| 76-85 | 63 | 79.88 | 0.40 | 0.93 | 2.51 | 44.30 |
| 66-75 | 164 | 70.98 | 0.33 | 0.87 | 2.46 | 45.45 |
| 56-65 | 98 | 61.84 | 0.27 | 0.81 | 2.16 | 45.94 |
| <55 | 17 | 50.12 | 0.25 | 0.62 | 1.82 | 46.89 |
| Overall | 356 | 69.84 | 0.32 | 0.86 | 2.36 | 45.33 |

Live Weight = 137.4 lb.; Dressing Percent = 50.8 %

NSIP EBVs

- Growth Traits
- Reproduction Traits
- **Carcass Traits:**
 - Loin muscle depth
 - Fat depth
- Wool Traits
- Parasite Resistance
- Indexes
 - **Carcass Plus Index**
 - USA Hair Index
 - USA Maternal Index
 - USA Range Index



NSIP

National Sheep
Improvement
PROGRAM

08J09



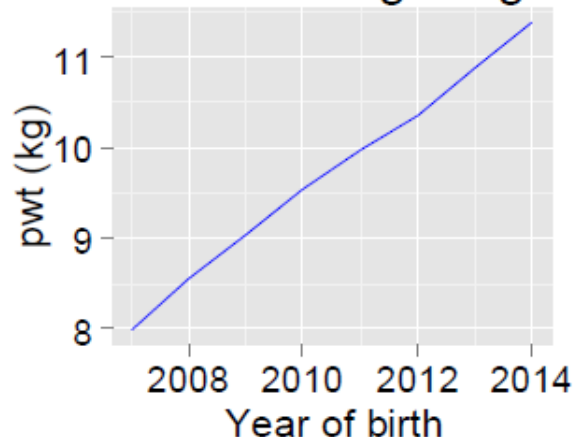
North Dakota 4-H

Lamb Ultrasound

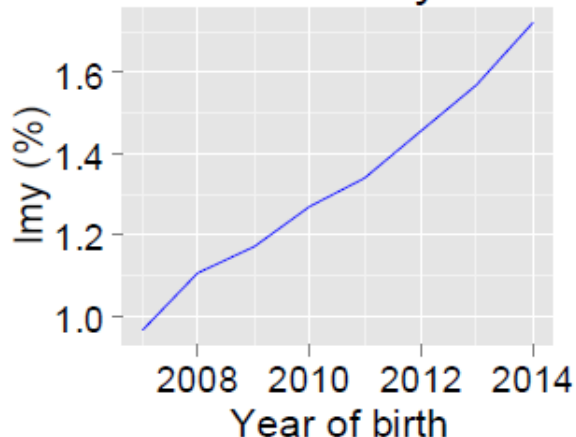
Carcass Value Evaluation

Australia Genetic Trends (2007-14)

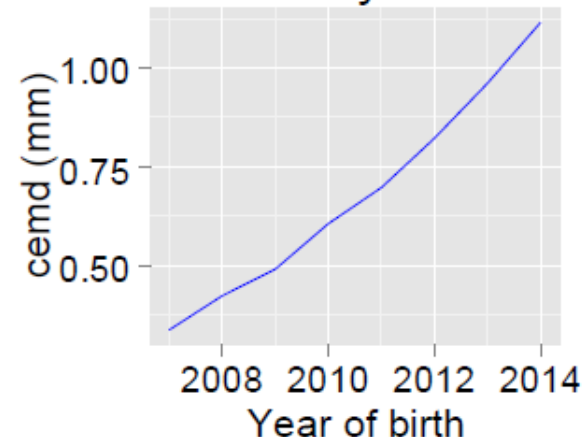
Post-weaning weight



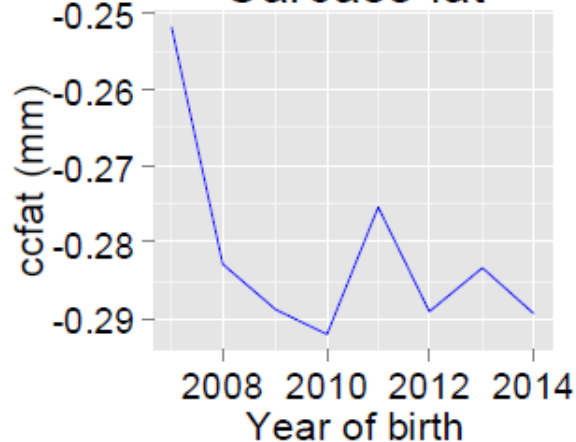
Lean meat yield



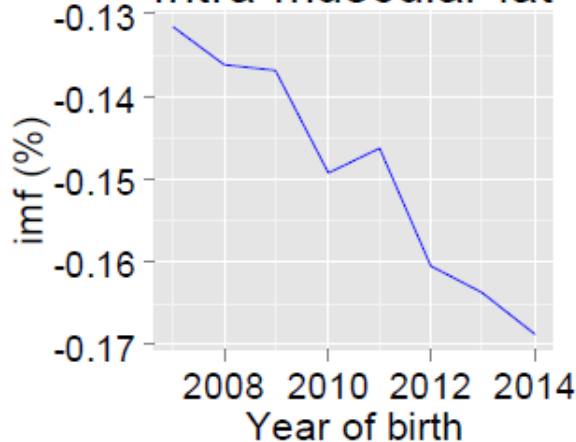
Carcass eye muscle



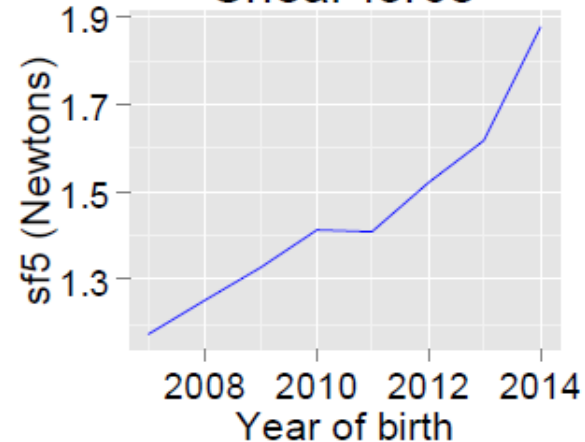
Carcass fat



Intra-muscular fat



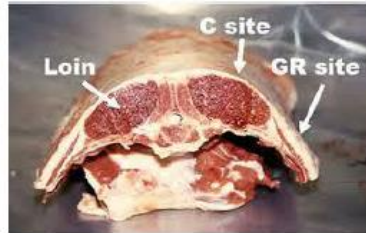
Shear force



Australian Competition



Animal performance



Carcass measurements



Consumer eating quality



Genomic testing

Index = Trait economic values X



SHEEP GENETICS



Australian Wool
Producers Limited



Least squares means for lamb flavor attributes between age class (corresponding range of ground cooked patties).

| Age ¹ | Lamb flavor Intensity | Off-flavor | Aroma |
|------------------|-----------------------------|---------------------------|---------------|
| Lamb | 27.38 ^a (16-43) | 9.42 ^b (0-28) | 29.65 (19-42) |
| Yearling | 21.44 ^b (12-35) | 5.32 ^b (0-26) | 31.76 (16-45) |
| Mature | 24.56 ^{ab} (14-44) | 22.56 ^a (1-63) | 29.0 (22-53) |
| SEM | 1.40 | 1.84 | 1.40 |
| P-Value | 0.0151 | <0.0001 | 0.3423 |

a, b, c Means within column lacking common superscripts differ (P < 0.05).

¹Age Lamb = 0 permanent incisors; Yearling = 2 permanent incisors; Mature = 2+ permanent incisors.



Lamb Flavor Compounds

3-methylindole (skatole)

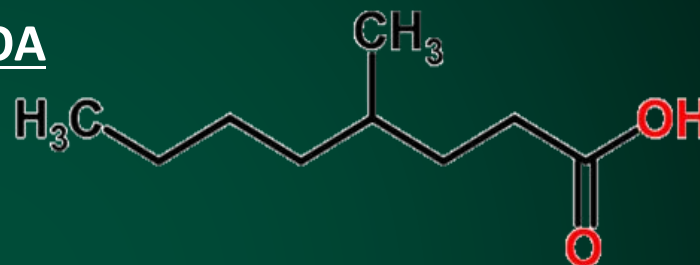
3MI



Threshold 10 ppb

4-methyloctanoic acid

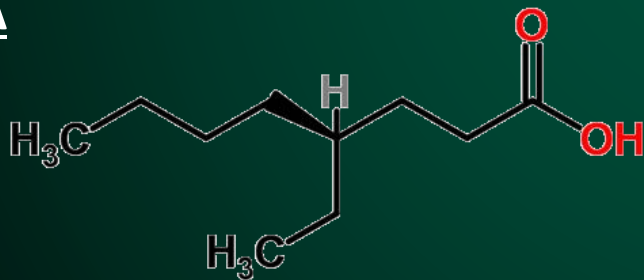
MOA



Threshold 20 ppb

4-ethyloctanoic acid

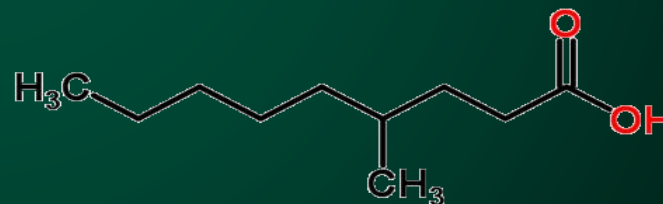
EOA



Threshold 6 ppb

4-methylnonanoic acid

MNA

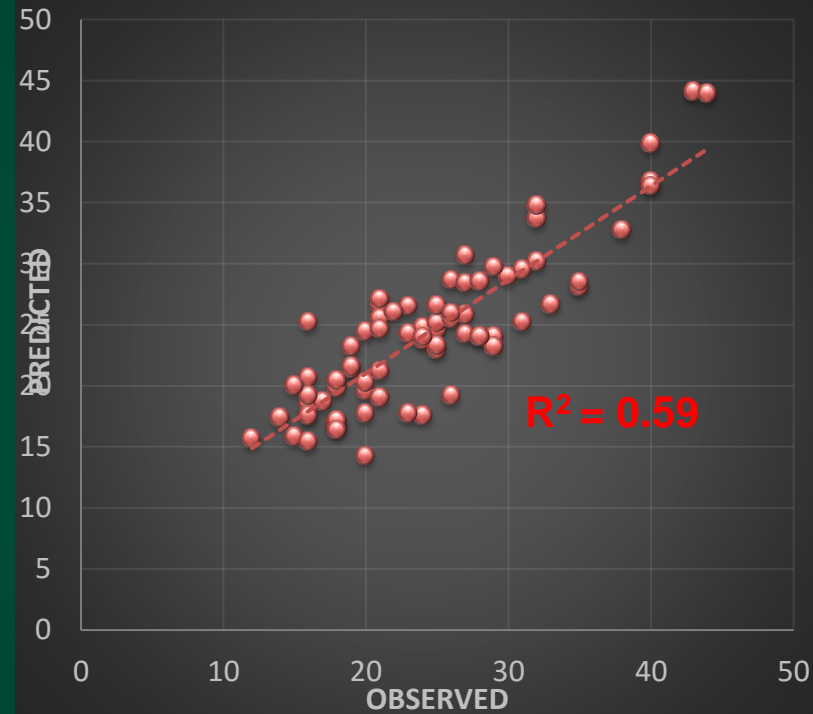


Threshold 650 ppb

Can we sort on lamb flavor?

Independent variables, R^2 , C(p), stepwise procedure for best-fit regression equations developed to predict lamb flavor.

| Dependent variable | R^2 | C(p) | Variables in model (partial R^2) | % accuracy |
|-----------------------|-------|--------|-------------------------------------|---------------------|
| Lamb Flavor Intensity | 0.59 | 5.2850 | C490 (0.1901) | 84 % Overall |
| | | | C75 (0.1186) | 67% Mild |
| | | | C455 (0.0763) | 75% Medium |
| | | | C129 (0.0478) | 92% Bold |
| | | | C274 (0.0987) | |
| | | | C22 (0.0372) | |
| | | | C494 (0.0213) | |



Adapted from:
Maneotis et al., 2016

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NDSU/U of M Lamb Research





Which lambs will:

Be the most marketable?

Taste the best?

Be the most tender?

Generate the most \$\$\$?



Eating Satisfaction

Best Management Practices

Production Factors

- Breed
- Sex
- Diet
- Age/Maturity
- Cutability
- Pre-harvest Stress
- Chill rate

Farm to Fork Mentality

- Gaining weight prior to slaughter
- USDA Yield Grade 2/3
- Muscular (> REA)
- Reduce pre-slaughter stress
- Importance of cooking
- Identify consumer preference
- Provide Celebrations of Life

EAT AMERICAN LAMB



Any Questions???



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