Current Research In Case Ready

55th Annual Reciprocal Meat Conference
Michigan State University

J. Brad Morgan
Oklahoma State University
50% Branded By 2005

Meat merchandising guru Joe Gordon sees a transformation in how to market beef in the next century.

By Greg Lamp
Managing Editor

It's depressing but true. Beef's market share is in the dumpster. In 1970, beef accounted for 44% of the market. By 2003, experts predict that it will tumble to a measly 29%. Compared to pork and poultry, beef is taking its lumps.

"We're absolutely going to struggle in the next five years to kill beef and make a profit," says meat merchandising guru Joe Gordon. "If you're in the commodity business, you'll have to add value."

Gordon, senior meat consultant with Sparks Companies, claims that by the year 2005, a shopping half of U.S. beef marketed will be branded. By then, he also predicts larger retailers will have a two-tiered system that will include a commodity and a branded beef product. Gordon is no stranger to the foodservice business. He spent seven years with Sara Lee working in their poultry division. After that, he clocked four years with Spartan Stores - a 500-store, co-op with lower-priced poultry, significantly more poultry must be thawed. "Retailers would rather sell higher-priced beef cuts," he says.

Unlike 1975 years ago, Gordon says retailers, not packers and processors, are now driving the beef sales process. And, he adds, it is why the proliferation of branded products will continue to build and be successful.

"We know the beef business is not going to survive as a commodity. Just look at all the models out there that are driving businesses from a customer's perspective, like pork and poultry. In fact, poultry is probably more branded than anyone ever anticipated," he says. "While I was at Sara Lee they had specs in place and producers had to meet them or go out of business."

"Poultry has taken costs out of the system and they've understood the requirements at the retail level and have spent R&D dollars to get there.

Unfortunately, with beef it's a slower process and more difficult to do because ultimately the R&D responsibility now ends up at the packer level. And so far, I'm not sure the retailers are willing to pay for it," Gordon points out.

The pork industry has made big strides in producing branded products. Today, they only have about two non-branded products that are commodity driven lugs and hams. And now, Gordon says, you're seeing those products being branded too.

"They've got their eye on the market and they can make money. Instead of 50 breeds, they're down to about three, or four, or five to meet the requirements," Gordon explains. "Through production, 500 swine and doing it doesn't make sense. It's because beef is more flexible.

Spartan Listens To Consumers

"Staying profitable is what keeps businesses like Spartan Stores viable. About five years ago, Gordon says Spartan came to the conclusion that their beef sales were deteriorating.

"Beef was about 45 percent of sales in the meat department. Revenue generating, however, it was much more than that," he says. "So, we surveyed our customer focus and realized that if we didn't do something different, we'd continue to lose market share.

As a result of its surveys, Spartan found that consumers wanted:

- Tenderness
- Flavor
- Consistency

Unlike many food retailers in the supermarket, Spartan Stores responded by developing a branded beef program based on 85-90% Choice, 70% 1s and 2s, with no outliers or dark cutters. They also choose a composite of 1 1/2 Angus (preferably Red Angus) plus 1/4 English (preferably Hereford).

When testing in their stores in 1996, they expected to initially sell about 10% of their beef volume as branded. Right out of the chute, though, they hit 20-25% branded.

"And if we can figure out how to market it better and include it with meals, we think we can soon be at 50 percent of our business," Gordon says.

At the retail level, the high-end branded product sells for 44 cents more than commodity beef. Of that, 24¢ is diverted to a promotion program paid by the retailer to drive the product through.

"We provided the product to our stores and it was the retailer's responsibility to move it," Gordon says.

We did, however, set up the marketing plan that changed the process from a push concept to a promotion-driven decision to move the product at a profit. "Commodity products are always driven from the price viewpoint while branded products are driven by marketing," Gordon says.

Besides specifications for the retail branded program, there is also an emphasis on promoting the export market, foodservice (Hill) and commodity beef for the producer, that markup means about $45.50/head more than selling strictly as an animal destined for the commodity market.

Today, Spartan is marketing about 100 head/week through their system.

"Commodity products are always driven from a price viewpoint," says Joe Gordon. "Branded products are driven from a marketing viewpoint."

Packer Buy In

Everyone in the chain – from producers to packers to retailers – needs to work together to turn beef's market share around, Gordon says.

"Regional niche packers are already in a branded mode to say in business he says. "In fact, I don't think the big packers are going to supply the demand if they don't get into a branded program."

Gordon believes the growing trend toward producer alliances with packers is a positive and necessary. And, he thinks they'll be successful if everyone involved keeps their eyes on the customer and keeps the supply pipeline full. "Alliances will come apart if everyone in the chain doesn't understand each other and make money, he says."
Case-Ready is Here

• It’s more than doubled in three years
  - 500 million packages in 1997
  - 1.2 billion in 2000
  - 2.8 billion by 2005

• Potentially 9 billion packages of red meat sold at retail annually
Key Case-Ready Producers

- IBP - > 10 million pounds per week
- Excel - > 4 million pounds per week
- Smithfield - > 1 million pounds per week
- Kroger - > 1 million pounds per week
- Farmland - > 1 million pounds per week
Case-Ready Savings: *Hear-Say??*

“Everyone remotely associated with the meat industry has heard the generalization that case-ready costs less.”

Case-ready is a *win-win-win* program:

- **Processors** can cut, package, price more efficiently.
- **Retailers** save on labor, shrink and out-of-stock.
- **Consumers** enjoy a better mix, classier packaging.

Source: MMT, June 2002.
Where's The Beef?

• With stores open around the clock, consumers often find very little meat “in-stock.” Case-Ready programs can/have solved this problem.

• This has been especially true for ground beef.
Case-Ready: Why do it?

- Cost Savings
- Less Shrinkage
- Food Safety—major issue!
- Better In-Stocks
- Employment Issues
Actual Savings with Case-Ready Meats

“When all costs were calculated, and reductions in shrink and labor inputs are added in, retailers on a case-ready program average about 6 percent greater gross profits, versus store-cut meat.”

Source: Richard Levin, North Carolina State University, 2002
Case Ready Production
Looking for New Product Ideas? Go Shopping

<table>
<thead>
<tr>
<th>Item Type</th>
<th>New Intros 8/31/01</th>
<th>%Gain, 2001 vs. 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candies, New Chocolate</td>
<td>335</td>
<td>+ 10.2%</td>
</tr>
<tr>
<td>Pizza, Hot Snacks</td>
<td>128</td>
<td>- 24.8%</td>
</tr>
<tr>
<td><strong>Meat</strong></td>
<td>86</td>
<td>+ 132.1%</td>
</tr>
<tr>
<td>Salad/Salad Kits</td>
<td>14</td>
<td>- 36.5%</td>
</tr>
<tr>
<td>Bottled Waters</td>
<td>55</td>
<td>+ 52.0%</td>
</tr>
<tr>
<td>Alcohol Drinks</td>
<td>103</td>
<td>+ 139.1%</td>
</tr>
</tbody>
</table>

Source: Marketing Intelligence Service, 2001
BEEF TRENDS

Source: USDA
Putting A Price On Your Life

According to marketing experts, *loyal customers* are worth more than the sum of their individual purchases:  

“Estimated Lifetime Value”

- **Procter&Gamble**: $10,000
- **GM**: $276,000
- **Safeway**: $4,800 / year
- **Coca-Cola Cap**: $6,000
- **Gateway**: $45,000
Recent Case Ready Packaging Research

- Reusable Crates/Totes
Reusable Transport Packaging

- In the U.S., corrugated cardboard boxes are used to carry over 90% of goods – especially for food and beverage products.
- In 1990, 25 billion boxes were made – that’s over 100 packages for every person.
- 1/3 of municipal solid waste is packaging.
- In fact, over ½ of packaging waste is transport packaging.

Source: Food Online, 2002
Benefits of Reusable Crates/Totes

- Able to be stacked, folded, collapsed into a small volume
- Durable & washable
- Very strong, resulting in less product damage
- Less material used and lower costs over time
- Can be used as display stands
- Reduced labor cost unpacking
- Better warehouse & vehicle space utilization
Recent Case Ready Packaging Research

- Reusable Crates/Totes
- Frozen Storage
According to Ken Parnell (VP Perishables, Wal-Mart), “Over 80% of all case-ready meat products goes directly into our customer’s freezers.”

• What impact does that have on product quality?
### Effect of storage on sensory and oxidative properties on fresh and frozen ribeye steaks

<table>
<thead>
<tr>
<th></th>
<th>Fresh Storage</th>
<th>Frozen Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At Fab</td>
<td>3d</td>
</tr>
<tr>
<td>Tenderness</td>
<td>----</td>
<td>6.00</td>
</tr>
<tr>
<td>Juiciness</td>
<td>----</td>
<td>5.50&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Salty</td>
<td>----</td>
<td>1.69</td>
</tr>
<tr>
<td>Soapy</td>
<td>----</td>
<td>1.25</td>
</tr>
<tr>
<td>Odor</td>
<td>----</td>
<td>2.14&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Purge, ml</td>
<td>----</td>
<td>0.56&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>TBA, mg/kg</td>
<td>0.18</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Source: Payne et al. (2002), Oklahoma State University

<sup>abc</sup> Means lacking common superscripts are different (P < .05)
Recent Case Ready Packaging Research

- Reusable Crates/Totes
- Frozen Storage
- Injection Sites
INJECTION-SITE LESION AUDITS
Fed Steer and Heifer Top Sirloin Butts

Incidence of Lesions
Percent Active Fluid-Filled Lesions

* Through July, 2000 only

SOURCE: Roeber et al. (2000)
The “Greening” of Injection-Site Lesions in Chucks in Modified Atmosphere Packages

Severity
Up to 20%
Recent Case Ready Packaging Research

- Reusable Crates/Totes
- Frozen Storage
- Injection Sites
- Food Safety Issues
Number of U.S. *E. coli* O157:H7 cases, 1997

(reported to Centers for Disease Control and Prevention)

(Total 298)
Technology is forging some promising gains in the struggle against microbial pathogens. Pictured here is Chad’s Pre-evisceration Carcass Wash and Pasteurization System in action.
Bacteria attach to tissue surfaces using “hair-like” structures called fimbria

LF eliminates fimbria and prevents bacterial attachment

Activated Lactoferrin
Eliminates essential attachment structures and prevents pathogen growth
Consumer Attitudes

Brand Food Safety “Natural Protection”
Recent Case Ready Packaging Research

- Reusable Crates/Totes
- Frozen Storage
- Injection Sites
- Food Safety Issues

- Vitamin E and Shelf-Life Extension
Vitamin E as an Antioxidant
Vitamin E and Peelable Films
Vitamin E Summary

• **Lean Color Scores**
  – Control +/- 0
  – Vitamin E +1.21 d
  – Control & Duralox +0.81 d
  – Control & Herbalox +0.65 d

• **Overall Acceptability Scores**
  – Control +/- 0
  – Vitamin E +0.94 d
  – Control & Duralox +0.51 d
  – Control & Herbalox +0.44 d

Source: Down et al. (2000), Meat Science Journal
Recent Case Ready Packaging Research

- Reusable Crates/Totes
- Frozen Storage
- Injection Sites
- Food Safety Issues
- Vitamin E and Shelf-Life Extension
- **Palatability Improvements Via Enhancement**
“Enhanced”

- To improve the quality, amount or strength of something
- To make greater, as in beauty or effectiveness
- To provide with improved, advanced, or sophisticated features
- To improve, cultivate, advance, strengthen, intensify

Get the look!
Enhance Financial Services Group Inc. is a leading provider of credit-based insurance and financial services in attractive niche markets.
Current Enhanced Infrared Satellite Image
“Enhanced Meats”

- Process of adding non-meat ingredients to fresh meat to improve eating quality, lean color, and ultimate case-life of the retail product.
Injection of beef strip loins with solutions containing sodium tripolyphosphate, sodium lactate, and sodium chloride to enhance palatability

D.J. Vote, W.J. Platter, J.D. Tatum, G.R. Schmidt, K.E. Belk, G.C. Smith, and N.C. Speer
Colorado State University

Methodology

• **Product: Choice and Select Strip Loins**
• **Enhanced to Produce:**
  – 0.25% STP, 0.5% NaCl, 2.5% sodium lactate
• **Pump Levels:**
  – 7.5%, 10%, 12.5%, and 15%
• **Measures:**
  – Shear force and trained sensory evaluation
### Results – Sensory and Shear

<table>
<thead>
<tr>
<th>Trait</th>
<th>10%H2O</th>
<th>7.5%PLC</th>
<th>10%PLC</th>
<th>12.5%PLC</th>
<th>15%PLC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tenderness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>5.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.07&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.40&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>6.23&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.72&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Diff</td>
<td>-.57</td>
<td>.97</td>
<td>.92</td>
<td>.97</td>
<td>.82</td>
</tr>
<tr>
<td>P value</td>
<td>.0047</td>
<td>.0001</td>
<td>.0001</td>
<td>.0001</td>
<td>.0001</td>
</tr>
<tr>
<td><strong>Juiciness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.35&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.91&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.07&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.27&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Diff</td>
<td>-.69</td>
<td>.92</td>
<td>1.18</td>
<td>1.07</td>
<td>1.17</td>
</tr>
<tr>
<td>P value</td>
<td>.0047</td>
<td>.0001</td>
<td>.0001</td>
<td>.0001</td>
<td>.0001</td>
</tr>
<tr>
<td><strong>WBS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.39&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.15&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.28&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.60&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Diff</td>
<td>.27</td>
<td>-.16</td>
<td>-.28</td>
<td>-.25</td>
<td>-.48</td>
</tr>
<tr>
<td>P value</td>
<td>.0293</td>
<td>.1751</td>
<td>.0211</td>
<td>.0418</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Vote et al., 2000
Farmland/National Beef Enhancement Study

*12 retail cuts
*Source identified
*USDA Select or higher
Farmland/National Beef Enhancement Study

David Enders, Nu-Meat Technology
Chance Brooks, Meat Group, OSU
Farmland/National Beef Enhancement Study

Jake Nelson, Meat Pilot Plant Mgr, FAPC, OSU
Metalquimia® (Auvistick-260, Girona, Spain) Injector
Laura Locke, Graduate Assistant, OSU
Jason Young, Service Technician, Harpak
Industry Control
## Warner-Bratzler Shear Force

<table>
<thead>
<tr>
<th>Trt</th>
<th>Chuck Tender</th>
<th>Shoulder Clod</th>
<th>Ribeye</th>
<th>Chuck Roll</th>
<th>Strip Loin</th>
<th>Top Sirloin Butt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.1&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>2</td>
<td>4.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td>4.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.4&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.3&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td>3.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Control</td>
<td>5.2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.3&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.3&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.3&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Source: Brooks et al. (2000)
## Sensory Panel Tendernessness

<table>
<thead>
<tr>
<th>Cut</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuck tender</td>
<td>5.6</td>
<td>6.5</td>
<td>5.3</td>
<td>6.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Shoulder clod</td>
<td>5.3</td>
<td>5.3</td>
<td>6.1</td>
<td>5.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Ribeye</td>
<td>5.3</td>
<td>6.0</td>
<td>6.2</td>
<td>6.1</td>
<td>4.3</td>
</tr>
<tr>
<td>Chuck roll</td>
<td>4.9</td>
<td>5.0</td>
<td>5.6</td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td>Strip loin</td>
<td>6.2</td>
<td>5.7</td>
<td>5.5</td>
<td>5.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Top sirloin</td>
<td>6.0</td>
<td>5.2</td>
<td>6.0</td>
<td>5.3</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Source: Brooks et al. (2000)
Future Case Ready Packaging Research

- Enhancement Refinement
## Enhancement Dilemma .. *When is enough enough??*

<table>
<thead>
<tr>
<th>Pump, %</th>
<th>WBS, kg</th>
<th>Mouthfeel&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.20&lt;sup&gt;x&lt;/sup&gt;</td>
<td>3.0&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>3.70&lt;sup&gt;y&lt;/sup&gt;</td>
<td>3.2&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>7.5</td>
<td>3.60&lt;sup&gt;y&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mouthfeel: 1= soft; 3= normal; 5=“rubbery”

<sup>x</sup>,<sup>y</sup>,<sup>z</sup> Orange means lacking common superscripts are different (P < .05)
## Enhancement Dilemma . . *When is enough enough??*

<table>
<thead>
<tr>
<th>Pump, %</th>
<th>WBS, kg</th>
<th>Mouthfeel&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.20</td>
<td>3.0</td>
</tr>
<tr>
<td>5</td>
<td>3.70</td>
<td>3.2</td>
</tr>
<tr>
<td>7.5</td>
<td>3.60&lt;sup&gt;x&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>10</td>
<td>3.50&lt;sup&gt;x&lt;/sup&gt;</td>
<td>3.7&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mouthfeel: 1 = soft; 3 = normal; 5 = “rubbery”

<sup>x</sup> Orange means lacking common superscripts are different (P < .05)
Enhancement Dilemma . . *When is enough enough??*

<table>
<thead>
<tr>
<th>Pump, %</th>
<th>WBS, kg</th>
<th>Mouthfeel&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.20</td>
<td>3.0</td>
</tr>
<tr>
<td>5</td>
<td>3.70</td>
<td>3.2</td>
</tr>
<tr>
<td>7.5</td>
<td>3.60</td>
<td>3.5</td>
</tr>
<tr>
<td>10</td>
<td>3.50&lt;sup&gt;x&lt;/sup&gt;</td>
<td>3.7&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>12</td>
<td>3.40&lt;sup&gt;x&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mouthfeel: 1= soft; 3= normal; 5=“rubbery”

<sup>xyz</sup> Orange means lacking common superscripts are different (P <.05)
Enhancement Dilemma . . *When is enough enough??*

<table>
<thead>
<tr>
<th>Pump, %</th>
<th>WBS, kg</th>
<th>Mouthfeel&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.20</td>
<td>3.0</td>
</tr>
<tr>
<td>5</td>
<td>3.70</td>
<td>3.2</td>
</tr>
<tr>
<td>7.5</td>
<td>3.60</td>
<td>3.5</td>
</tr>
<tr>
<td>10</td>
<td>3.50</td>
<td>3.7</td>
</tr>
<tr>
<td>12</td>
<td>3.40&lt;sup&gt;x&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>15</td>
<td>3.30&lt;sup&gt;x&lt;/sup&gt;</td>
<td>4.2&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mouthfeel: 1 = soft; 3 = normal; 5 = “rubbery”

<sup>x</sup> Orange means lacking common superscripts are different (P < .05)
Enhancement Dilemma . . When is enough enough??

<table>
<thead>
<tr>
<th>Pump, %</th>
<th>WBS, kg</th>
<th>Mouthfeel&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.2&lt;sup&gt;x&lt;/sup&gt;</td>
<td>3.0&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>3.7&lt;sup&gt;y&lt;/sup&gt;</td>
<td>3.2&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>7.5</td>
<td>3.6&lt;sup&gt;y&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;xy&lt;/sup&gt;</td>
</tr>
<tr>
<td>10</td>
<td>3.5&lt;sup&gt;yz&lt;/sup&gt;</td>
<td>3.7&lt;sup&gt;xy&lt;/sup&gt;</td>
</tr>
<tr>
<td>12</td>
<td>3.5&lt;sup&gt;yz&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;y&lt;/sup&gt;</td>
</tr>
<tr>
<td>15</td>
<td>3.4&lt;sup&gt;z&lt;/sup&gt;</td>
<td>4.2&lt;sup&gt;z&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mouthfeel: 1= soft; 3= normal; 5=“rubbery”

<sup>xyz</sup> Column means lacking common superscripts are different (P < .05)
Future Case Ready Packaging Research

- Enhancement Refinement

- Carbon Monoxide “Go-Ahead”
Evaluation of carbon monoxide treatment in modified atmosphere packaging or vacuum packaging to increase color stability of fresh beef
Summary of Results

0.5% CO in MAP -- week 8

100% CO in VP – week 5

5% CO in VP – week 3

Source: Jayasingh et al. (2001) Meat Science Journal
CO as a component of a gas mixture in MAP systems.

- GRAS approved
- 0.4 percent level
- Meat would be removed from MAP prior to display
- No labeling issues
Future Case Ready Packaging Research

- Enhancement Refinement
- Carbon Monoxide “Go-Ahead”
- Oxygen Saturation Chamber
Hilton Head, SC
Metropolitan Statistical Areas of the United States - 2002
Too Much Plastic!!

MAPtech Film Contact System
Tray Color Suggests “Best” Quality

The tray associated with “best” quality was black plastic.

• The most appealing trays by cut were:
  • Bone-in pork chops: black plastic
  • Boneless chicken: black plastic
  • Ribeye Steak: black, white, rose plastic
  • Boneless pork chops: black plastic
  • Ground beef: black, blue or white plastic
  • Ground pork: white plastic

Source: National Pork Producers Council, 2001
STRESS
Future Case Ready Packaging Research

- Enhancement Refinement
- Carbon Monoxide “Go-Ahead”
- Oxygen Saturation Chamber
- Intelligent Packaging
Intelligent Packaging Systems

• Relatively new on the scene:

These systems measure a component and signals the result. For example, the signaling of the presence of spoilage/pathogenic microorganisms in food.

*Examples:* Moisture controllers
              Oxygen scavengers
              Theft deterents
              Biosecurity threats
Future Case Ready Packaging Research

- Enhancement Refinement
- Carbon Monoxide “Go-Ahead”
- Oxygen Saturation Chamber
- Intelligent Packaging
- Guaranteed Tenderness
The #1 Reason Consumers Purchase Beef -- TASTE!
If It Ain't Broke, Don't Fix It
Meat Science Program