Progress Report: Factors affecting sheep meat flavor

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Introduction

• Investigate the effects of....
  1) diet
  2) sex
  3) maturity

.... on the production of volatile compounds responsible for sheep meat flavor.
Experimental design – Trial 1

<table>
<thead>
<tr>
<th>Diet</th>
<th># Ewe lambs</th>
<th># Yearling ewes</th>
<th># Mature ewes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa pellets</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Whole shell corn</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

• Investigate the effects of **diet** and **maturity** in ewes
Experimental design – Trial 2

<table>
<thead>
<tr>
<th>Maturity × Sex</th>
<th>Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alfalfa pellets</td>
</tr>
<tr>
<td>Lamb; ewe</td>
<td>8</td>
</tr>
<tr>
<td>Lamb; wether</td>
<td>8</td>
</tr>
<tr>
<td>Yearling; ewe</td>
<td>8</td>
</tr>
<tr>
<td>Yearling; wether</td>
<td>8</td>
</tr>
</tbody>
</table>

• Investigate the effects of diet, sex, and maturity
### Experimental design – Trial 3

<table>
<thead>
<tr>
<th>Location</th>
<th># Ewe lambs</th>
<th># Wether lambs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Oregon</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Montana</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Wyoming</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th># Ewe lambs</th>
<th># Wether lambs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Western</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>
Sample collection

• Lambs, Yearlings (trial 1), and ½ Mature ewes (trial 1) were collected during the summer

• Long-fed lambs and other ½ Mature ewes (trial 1) were collected in December
Performance Results

• Ad lib. WSC fed lambs had the greatest **ADG** (0.82 vs. 0.65, 0.68), **G:F** (0.258 vs. 0.146, 0.242) compared to alfalfa and limit-fed lambs

• Ad lib. WSC fed lambs required the fewest **days on feed** (87.5 vs. 110.2, 104.8) and had the lowest **feed cost of gain** (0.42 vs. 2.10, 0.49) compared to alfalfa and limit-fed lambs
Performance Results

• Alfalfa fed lambs had the greatest **DMI** (4.43 vs. 3.17, 2.81) compared to ad lib. WSC and limit-fed lambs

• Wethers had greater **final weights** (140.7 vs. 133.7) compared to ewe lambs

• Wethers **consumed more feed** (3.55 vs. 3.39) than ewe lambs
Carcass Results

• Alfalfa fed lambs produced less **kidney** (521 vs. 951, 796) and **visceral** (1690 vs. 2230, 2130) fat compared to ad lib. and limit-fed WSC fed lambs

• Alfalfa fed lambs produced greater **digestive tract masses** (3700 vs. 3120, 2990) compared to ad lib. and limit-fed WSC fed lambs
Carcass Results

- WSC fed lambs produced carcasses with greater **backfat** (0.38, 0.35 vs. 0.21) and **bodywall** (1.06, 1.03 vs. 0.76) thicknesses compared to lambs fed alfalfa pellets.

- WSC fed lambs produced carcasses with greater **marbling scores** and **yield grades** (4.18, 3.88 vs. 2.45) compared to lambs fed alfalfa pellets.
Carcass Results

• WSC fed lambs produced carcasses with greater dressing percents and carcass weights (82.7, 74.8 vs. 68.0) compared to lambs fed alfalfa pellets

• Wether lambs produced greater carcass weights (78.2 vs. 72.1) compared to ewe lambs
Backfat Thickness

0.30 in

0.80 in
Sheep meat flavor

• “off-flavors” provide consumers with inconsistent eating experiences with sheep meat
  • mutton flavor or pastoral flavor
Mutton Flavor

• Branched-Chain Fatty Acids (BCFA)
  • 4-methyloctanoic acid
  • 4-methylnonanoic acid
  • 4-ethyloctanoic acid

Wong et al. (1975)
Young et al. (2003)
Watkins et al. (2014)
Pastoral Flavor

• 3-methylindole (skatole)
  Young et al. (2003)
  Schreurs et al. (2007)
  Watkins et al. (2014)
Selected Ion Flow Tube – Mass Spectrometry

SIFT-MS

• Real-time quantification
• No sample preparation
• Detects volatile compounds to parts-per-trillion/volume level
What have we done so far???

• Sample collection

• Created methods for detection of 4 volatile compounds using SIFT-MS

• Analyzed lamb data
Validations for SIFT-MS

• Started creating equilibration curves for each of the volatile compounds

• Preliminary sampling of shoulder samples from trial 1 with SIFT-MS
Method development for sheep meat compounds

• Determine the dynamic range of detection for the 4 volatile compounds of interest

• Determine if there are any interactions between and among the volatile compounds

• ‘Spiking’ experiment with control sheep meat
To Do List

• Determine the dynamic range of detection for the 4 volatile compounds with SIFT-MS
To Do List

• Finish creating the equilibration curves for the 4 volatile compounds
To Do List

• Sample meat and fat samples collected from sheep with SIFT-MS

• Analyze data
Any Questions