Feeding Strategies to Reduce Greenhouse Gas Emissions by Pigs

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Methods to reduce GHG from Pigs

• **Improve carbon retention by the pig**
  – when higher % of dietary carbon is retained in the body, less is excreted:
    • As CO₂ and CH₄ from animal and
    • As fermentable C in the manure _ less CH₄ from manure

• **Improve % diet nitrogen retained by the pig**
  – less N is excreted from animal therefore less N in manure to become N₂O (0% to 50%)

• **Reduce hindgut fermentation of dietary C & N**
  – therefore less CH₄ and N₂O released from both pig and manure
How to achieve lower GHG from Pigs

• **Improve growth rate and feed conversion**
  – diet, genetic selection and feed additives

• **Reduce dietary protein**
  – supplement with amino acids or improve protein digestibility.

• **Reduce dietary non-starch polysaccharides (NSP)**
  – Choose ingredients with more digestible CHO
  – Add CHO enzymes and feed additives.
New U of A Swine Research & Technology Centre
Calorimetry Equipment
CO₂, O₂, CH₄, heat
Sow Respiration System
Grower Pig Respiration System
Research Completed

• Developed and validated CO$_2$ and CH$_4$ measurements in sows & growing pigs.

• Effect of low protein diets on GHG emission by non-pregnant, pregnant and lactating sows.

• Effect of Standard, Low and Very Low protein diets on GHG emission by growing pigs.

• Comparison of barley vs corn based diets for GHG emission by sows and growing pigs.
Research in Progress

- Effect of Phytase, and Xylanase supplementation to Standard and Low Protein diets on CHO digestibility & GHG emissions.
  - Increase CHO digestibility __fermentation = _ CH₄

- Unfunded – lack matching $ reqd
- Sow amino acid reqts – need more info

- NE value of Cdn feeds (replace DE & ME)
  - Use of NE in diet formulation will reduce feeding value of NSP feeds __ fermentation in gut & manure = _CH₄
CH₄ production (Mean ± SE) by non-pregnant sows fed corn-based diets

CH₄, L/min

Time (min)

Corn LP  Corn HP
### CH$_4$ production (g/d) by sows fed barley- or corn based diets

<table>
<thead>
<tr>
<th></th>
<th>Low protein (LP)</th>
<th>Conventional diet (HP)</th>
<th>LP vs. HP P =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>8.9 ± 1.0</td>
<td>21.4 ± 1.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Corn</td>
<td>11.7 ± 1.8</td>
<td>8.8 ± 0.6</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Barley vs. corn: p = 0.19

Barley vs. corn: p = 0.001
CH₄ production by finishing pigs fed barley-based diets

CH₄, L/min

Time (min.)

Barley HP  Barley LP
### CO₂ and CH₄ production (mean ± SE) by finisher pigs

<table>
<thead>
<tr>
<th></th>
<th>LP</th>
<th>HP</th>
<th>HP vs. LP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂, g/d</td>
<td>2098 ±124</td>
<td>2500 ±297</td>
<td>0.25</td>
</tr>
<tr>
<td>CH₄, g/d</td>
<td>12.4 ±1.9</td>
<td>19.7 ±2.3</td>
<td>0.03</td>
</tr>
</tbody>
</table>
Summary of Results

• Sows and growing pigs fed diets using corn & soybean produce about less 20% GHG than pigs fed barley & canola

• Pig diets formulated to Low protein:
  – Increase % diet C and N retained by the pig by 10-20%
  – Reduce fermentable CHO in diets __ CH4
  – Works in sows __ CH4 by 30 - 40 %
  – Works in growing pigs __ CH4 40 - 50 %
Sum of strategies to reduce GHG from Pigs

- Improve growth rate & feed conversion
  - 10-15% decrease in GHG emissions

- Reduce dietary protein
  - 15-20% decrease in GHG emissions

- Reduce dietary non-starch polysaccharides
  - 10% decrease in GHG emissions

- Total diet effects -- 35-45% maximum
Additive Strategies to reduce GHG from Pigs

Diet effects are Additive to and precede manure management.

A 20% increase in dietary C and N retention __ 20% reduction in C and N in manure. __ immediate 20% __ potential manure CH₄ & N₂O

Any improvements in manure management are additive to the Dietary Improvements
Faster gaining, growing and finishing hogs
Our Knowledge is your advantage

Department of Agricultural Food and Nutritional Science