Livestock Greenhouse Gas Mitigation

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Recent Activities

- CAST report
  - *Carbon Sequestration and Greenhouse Gas Fluxes in US Agriculture: Challenges and Opportunities*

- USDA efforts
  - *Multi-institutional evaluations of existing mitigation opportunities and models*
- Overview of enteric and manure greenhouse gas emissions
- Enteric CH$_4$
  - Improved diet digestibility
  - Additives
  - Improved genetics
- Manure CH$_4$ and N$_2$O
  - Cooling, covering, solid separation, and CH$_4$ capture
  - Primarily a function of manure management system
  - Large data gaps on amendments within systems
Enteric Methane

- Diet digestibility
  - *Increasing starch provision to ruminants*
  - *Pasture improvement*
    - Species
    - Fertilization
    - ???
Enteric Methane

- **Additives**
  - *Improve performance*
    - Implants, beta-agonists, etc.
  - *Decrease methanogenesis*
    - Ionophores
    - Fatty acids
    - Halogenated compounds
    - Saponins, tannins, essential oils
    - Probiotics/prebiotics
    - Fumaric or malic acid
    - Vaccination
Enteric Methane

- Improved genetics
  - Primarily a function of maintenance requirements
  - Greater productivity
  - Decreased time from birth to slaughter, lactation, etc.
  - Decreased dry periods
  - Mitochondrial efficiency
  - Overall efficiency
    - RFI, F:G, G:F, etc.
  - Potential undesirable side effects.
Manure Emissions

- Methane capture
- Cooling
- pH
- Spreading
- Feeding practices
  - Type and form of protein
- Performance enhancement
  - Particularly for N
Improved feeding practices
  - 16% in dairy cattle, 11% in beef cattle, and 4% in sheep

Additives
  - 11% in dairy cattle, 9% in beef cattle, and 0.4% in sheep

Genetics
  - 3% in dairy cattle, 3% in beef cattle, and 0.3% in sheep
  - Assume a 20% reduction in impact due to non-additivity (Smith et al. 2007)
Limitations/Challenges

- Units for measurement
  - $CO_2e$ per kg of meat, milk, protein, amino acid, calorie
- System wide implications
  - Corn, fats, etc.
- Deleterious side effects
  - Animal welfare, profitability, “other” emissions
- “Compartmentalization” of emissions
- Difficult to identify baseline practices
- Implementation barriers
  - Market bans, acceptability, profitability
Questions?