

Livestock Greenhouse Gas Mitigation



SHAWN ARCHIBEQUE

**COLORADO STATE UNIVERSITY
DEPARTMENT OF ANIMAL SCIENCES**

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*

CAST Report



- Overview of enteric and manure greenhouse gas emissions
- Enteric CH₄
 - *Improved diet digestibility*
 - *Additives*
 - *Improved genetics*
- Manure CH₄ and N₂O
 - *Cooling, covering, solid separation, and CH₄ 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*

Scale



- 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
 - *CO₂e 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?

