• Problem
• Six-year summary
• Lab studies
• Field study—Monensin
• Monensin recommendations
• Producer survey, fall 2012
• Future plans
Foam
Foam destruction
Foaming needs

• Biogas generation
  – CH4, CO2, H2S

• Surfactants
  – Decrease surface tension

• Stabilizer
  – Increases bubble stability
  – Filamentous bacteria
  – Small fiber
  – Other hydrophobic particles
History—manure deep-pit foaming

- “Flash fires” and foaming
  - 5-6 years ago
- 2009 summer/fall
  - Barn explosions
  - Flash fires
- Pit foaming related
Common foaming situations

• Same farm
  – One pit or barn foams
  – Others don’t foam
• Problem over time (1-2 yr)
  – Once established, very fast growing
• Sensitive trigger
Producer survey

• 28% of producers, 26% of pits foam
  – Limited to upper Midwest
  – Isolated other locations
Producer survey

- 28% of producers, 26% of pits foam
- No clue as to cause—facilities
  - Building (room) type, size, or age
  - Type of waterer (nipple/cup) or feeder (dry/wet-dry)
  - Room cleaning technique
  - Pit additives or pumping frequency
  - Genetics
  - Diet
  - Management
Producer survey

- 28% of producers, 26% of pits foam
- No clue as to cause—manure character
  - Manure crust presence
  - pH
  - Solids content
  - Nutrients
  - Strength—COD
  - Lipid (fat) content (maybe)
Lab summary

- Bacteria screening
  - Differences in species
  - Differences in communities
## Manure compositional change

<table>
<thead>
<tr>
<th></th>
<th>Total Solids %</th>
<th>Organic Nitrogen %DM</th>
<th>Total Nitrogen %DM</th>
<th>Ammonia Nitrogen %DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foaming layer</td>
<td>9.0</td>
<td>0.42</td>
<td>0.88</td>
<td>0.46</td>
</tr>
<tr>
<td>Foaming liquid</td>
<td>5.2</td>
<td>0.25</td>
<td>0.71</td>
<td>0.45</td>
</tr>
<tr>
<td>Non-foaming liquid</td>
<td>5.3</td>
<td>0.23</td>
<td>0.74</td>
<td>0.51</td>
</tr>
</tbody>
</table>
Foaming Index
Fishing for ideas

Educated guess

Guess, BA, MA, PhD
FI results when added immediately

A: digested manure
B: raw manure
One week

- Control
- Yeast extract
- Corn oil
- DDGS
- VFA
- Trace metals

Foaming Index

Non-foaming digested manure
Seeded digested manure
Non-foaming raw manure
Seeded raw manure
Four weeks

- **Control**
- **Yeast extract**
- **Corn oil**
- **DDGS**
- **VFA**
- **Trace metals**

**Foaming index**

- Yellow: Non-foaming digested manure
- Orange: Seeded digested manure
- Green: Non-foaming raw manure
- Yellow: Seeded raw manure
Current lab research—summary

• Surface oil addition
  – Short-term benefit
  – Long-term bigger problem
    • Better carbon balance
Current lab research—summary

- Surface oil addition
- No real impact
  - Yeast extract
  - DDGS
  - VFA
  - Trace metals
Current lab research—summary

- Surface oil addition
- No real impact
  - Yeast extract
  - DDGS
  - VFA
    - Glycerol – short chain
    - Oleic acid – long chain
  - Trace metals
Field research—monensin
Foaming ↔ Bloat

- Borrowed from beef production
- Rumensin
  - Alters biochemistry pathway in rumen
    - Increased volatile fatty acids
    - Decreased methane
- Bloat Guard
  - Reduces frothy bloat in grazing cattle
Experimental procedure

• Typical grow-finish buildings
  – 1000- to 1100-head capacity
  – Single- or double-wide barn layout
  – 8-ft-deep pits
  – Same or nearby sites, same producer
Experimental procedure

• Added Rumensin-90 directly to the pit
  – Similar rates to feeding
• Rates / 100,000 gal manure
  – 0 lbs (control)
  – 2.5 lbs
  – 5.0 lbs
  – 10.0 lbs
Experimental procedure

• Rumensin-90
• Added Bloat Guard
  – Rumensin-90 (control @ 5 lbs)
  – 60 lbs
  – 100 lbs
Site E--Rumensin

Foam depth (inch)

Application rate (lb)
- 0
- 2.5
- 5
- 10

Sampling period

Preapplication  3-wk post  6-wk post

Foam depth: 0, 2.5, 5, 10
Safety - Rumensin

• Human handling
  – Causes eye burns
  – Allergic skin reaction
  – Harmful if swallowed
  – Respiratory tract irritation

• Swine
  – Lethal if enough consumed
  – 0.1 lb product per 100 lbs liveweight
Safety - Rumensin

• Environmental
  – Toxicity to fish
  – LC50 for 96 hr
    • Lethal concentration 50% of population
  – Rainbow trout: 9.0 mg/L
  – Bluegill sunfish: 16.6 mg/L
Safety - Rumensin

• Environmental
  – Rainbow trout: 9.0 mg/L

• Playing the what if game
  – 5 lb / 100,000 gal
  – 50% reduction in pit
  – 6000 gallons / acre; 10% runoff
  – 1 inch rain; 75% runoff
  – 0.018 mg/L (0.2%)
Safety - Rumensin

- Environmental
  - Rainbow trout: 9.0 mg/L
- Playing the what if game
- Half life in soil
  - 7 days
Regulations - Rumensin

• FDA
  – None, not being fed

• MPCA
  – No official statement

• MDA
  – Non-Pesticide
Bottom line

- Rumensin-90—Preventive
  - 1-2 lbs after pumping pits
Bottom line

• Rumensin-90—Preventive

• Rumensin-90—Active foam
  – Suggest 5 lbs / 100,000 gallons
    • Lower rate (< 5 lbs) may work
      – Take additional material
      – Longer period
  – About 10-14 days to see response
    • Maybe 30 days
Bottom line

- Rumensin-90—Preventive
- Rumensin-90—Active foam
  - Interaction with other pit additives
  - No clue
Research direction

• Multiple state
  – Iowa
  – Illinois
  – Minnesota

• Multi-year project
Research direction

• Multiple state / Multi-year project
• Producer survey
  – Fall, 2012
  – Fall, 2014
  – Compare 2009
Producer survey—Fall 2012

• 18 Producers
• Low response
  – High prices
  – Drought
  – Not a concern
  – PRRS
  – ????
Producer survey—Fall 2012

Commercial break
Producer survey—Fall 2012

- 18 Producers
- 4 States
- 102 Rooms
  - 71% grow-finish
  - 29% wean-finish
- 80 pits
18 Producers

15 Producers had foam
  - 39 foaming pits
  - 49% of total pits in survey
  - 29% in 2009
Producer survey—Fall 2012

• 18 Producers
• 15 Producers had foam
• 3 Producers had flash fire
  – Pumping / agitation
  – Repair work
Producer survey—Fall 2012

- Checking for foam
  - Weekly – 53%
  - Monthly – 33%
  - Semi-annually – 13%

- Foaming first concerns
  - Summer – 33%
  - Fall – 50%

- Pumping frequency
  - 33% once / year
  - 61% twice / year
  - 6% three / year
Producer survey—Fall 2012

• Reducing foam
  – Nothing – 27%
  – Agitate – 7%
  – Pumped out – 20%
  – Sprayed water – 20%
  – Pit additive – 53%
  – Feed additive – 7%
  – Mineral / Vegetable oil – 0%
  – Diesel fuel – 7%
Research direction

• Multiple state / Multi-year project
• Producer survey
• Extensive manure sampling
  – Testing for everything
  – Microbial communities
  – Long chain fatty acids
  – Lead by University of Illinois
Research direction

• Multiple state / Multi-year project
• Producer survey
• Extensive manure sampling
• Dietary feeding trials
  – Long chain fatty acids (forms bubbles)
  – Micro-fiber (maintains bubble)
• Multiple state / Three - year project
• Producer survey
• Extension manure sampling
• Dietary feeding trials
  – Micro-fiber
  – Long chain fatty acids
Questions??