A microbial lens into the causes of manure pit foaming

Fan Yang

Multiple microbial processes are involved in methane production.

- Methanogens
- Archaea
- Anaerobic bacteria
- Final step in decomposition of biomass

Feed inputs
- Microbiome
  - Bacterial members (whole community)
  - Methanogen members
- Chemical:
  - Long Chain Fatty Acid (LCFA) / Short Chain Fatty Acid Concentrations
  - Carbon, potassium, manganese, ...
  - Fiber
  - Methane production rates
- Physical:
  - Surface Tension
  - Viscosity
  - Foaming capacity

No Foam
Crust
Forming Foaming
Transition
Slurry
Crust Foam
Transition Top
Slurry
Sludge

Agricultural and Biosystems Engineering
Sequencing allows to not only compare sample similarity but identify who and how many.

Bacterial communities from non-foaming (No Foam), crust-forming (Crust), and foaming (Foam) manure samples were significantly different.

In the environment, no man is an island...
Interactions in foaming and non-foaming

- Non-foaming
  - Interactions within Firmicutes

- Foaming
  - Interactions among Bacteroidetes, Proteobacteria, and Firmicutes

Lactobacillus (bacilli) significantly more abundant in non-foaming manures, which is also negatively correlated with Clostridia (inhibited by SCFAs).

Note: Not all “Clostridia” are the same species.
Mitigation – Proteins or Methane?

(1) Good success in the lab, so trying it in a barn.

(2) Cumulative Methane Production (Percent of Control) vs. Days of Incubation

(Iowa State University)

Mitigation – Proteins or Methane?

Microbial Community

(Iowa State University)