

Manure Processing: Microbial Impacts on Manure Management Strategies

July 13, 2016

Becky Larson

Assistant Professor and Extension Specialist

Biological Systems Engineering

University of Wisconsin-Madison



Why Apply Manure to Alfalfa?



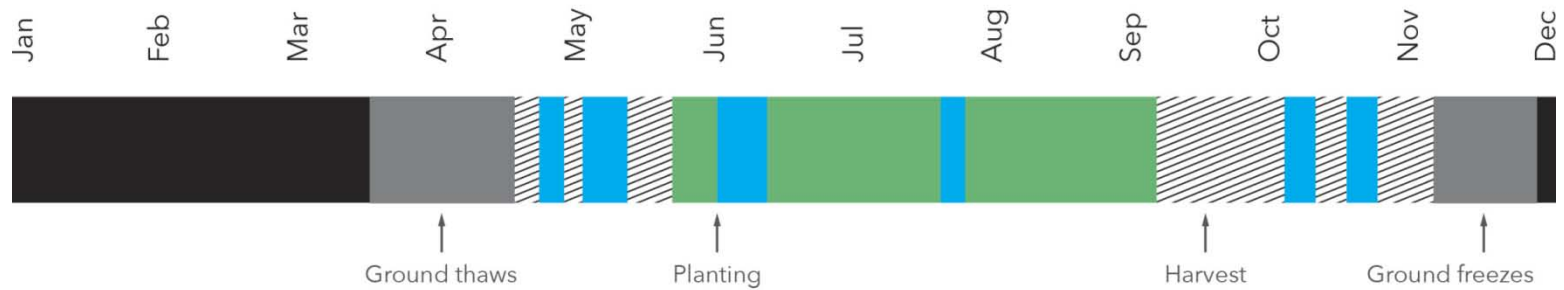
- requires phosphorus and potassium
- benefit from the micronutrients, particularly boron
- removes large amounts of nitrogen from the field when harvested as hay, and draw down nitrate levels within its root zone
- typically have low erosion, nutrient runoff and nutrient leaching potential
- opportunities for manure application throughout the year

Land Base Declining

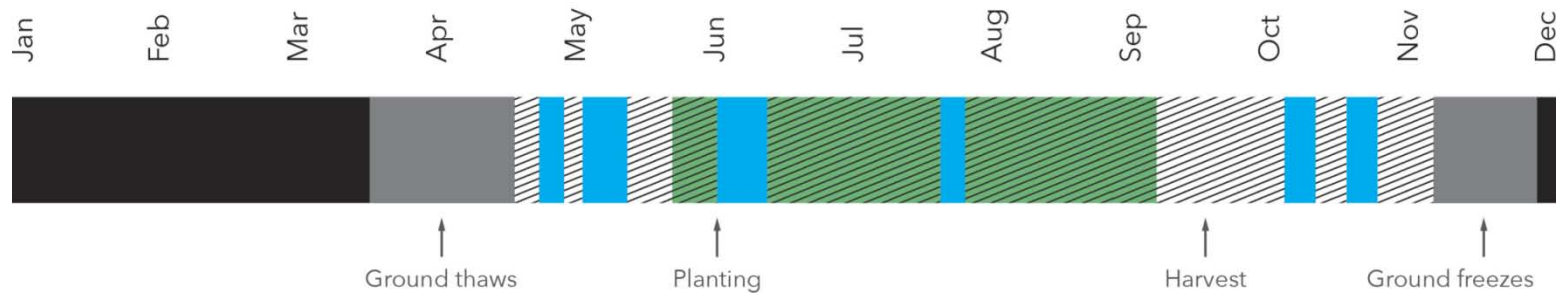
Area of manure application	Small (1-99)	Medium (100-199)	Large (200-999)	Permitted (>=1000)	All
(Ha)	83 / 72	121 / 105	286 / 248	788 / 738	418 / 267
	8	19	35	35	97
(Ha/AU)	1.07 / 0.97	0.88 / 0.77	0.68 / 0.59	0.40 / 0.34	0.65 / 0.54
	8	19	35	35	97

Application Timing

Without Irrigation



With Irrigation



Color Key:



Manure Application







Draghose Lines





Traveling Gun

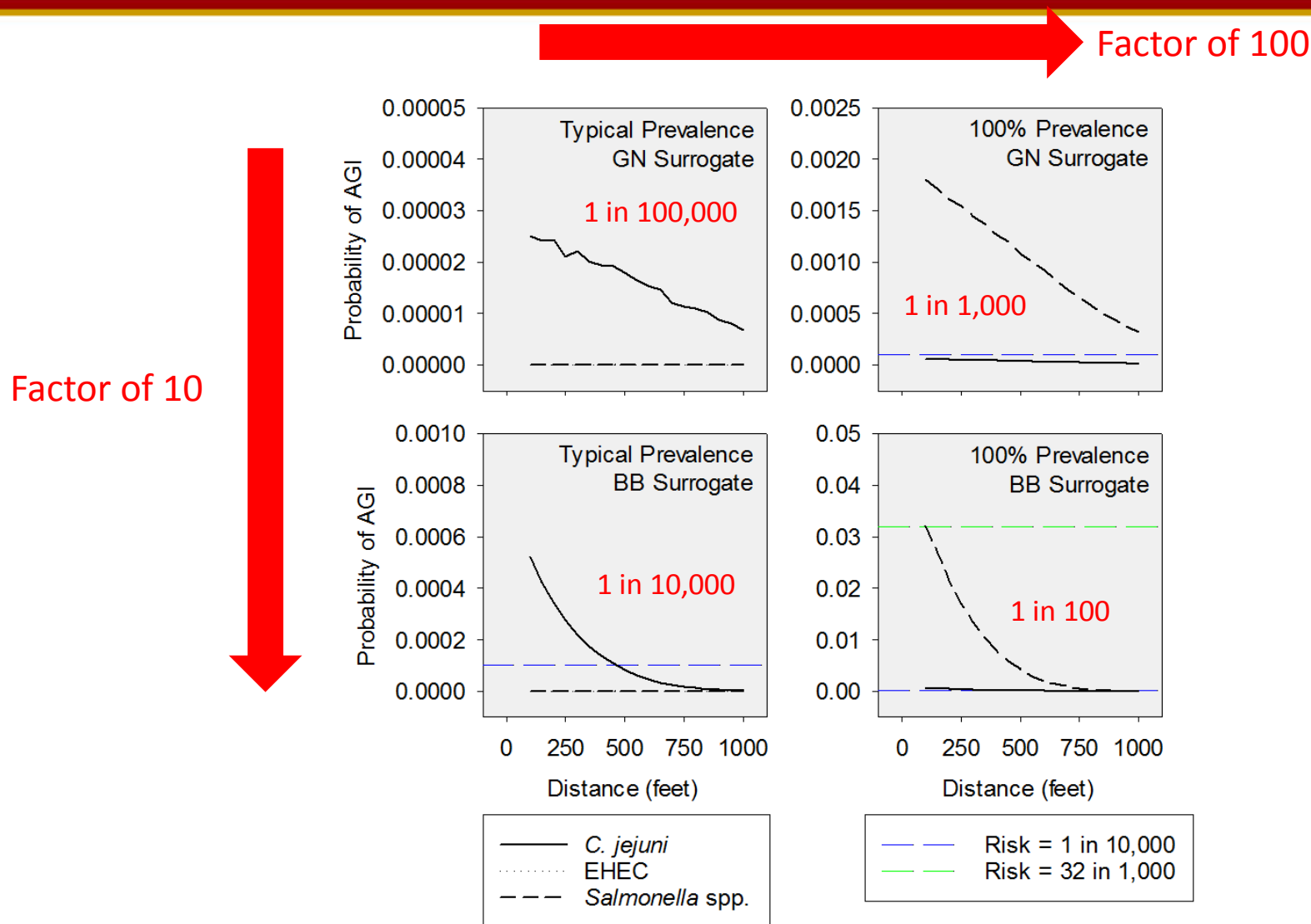




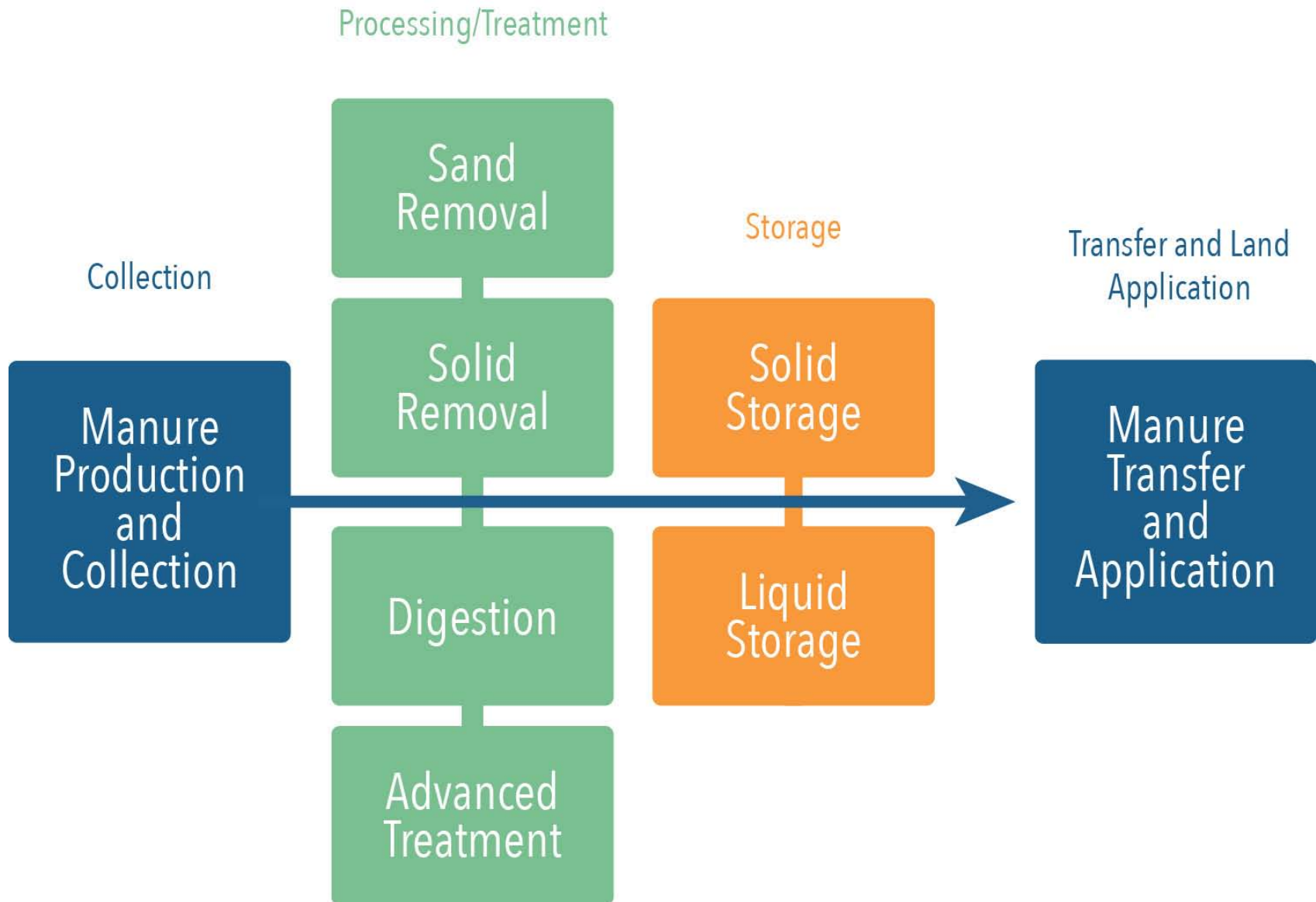
Center Pivot



Risk vs. Distance



Manure Systems



Manure Handling

Manure
Collection



Manure
Processing/
Treatment



Manure
Storage



Land
Application or
Final
Treatment



Anaerobic Digestion



Covered Lagoons



Dry Digestion



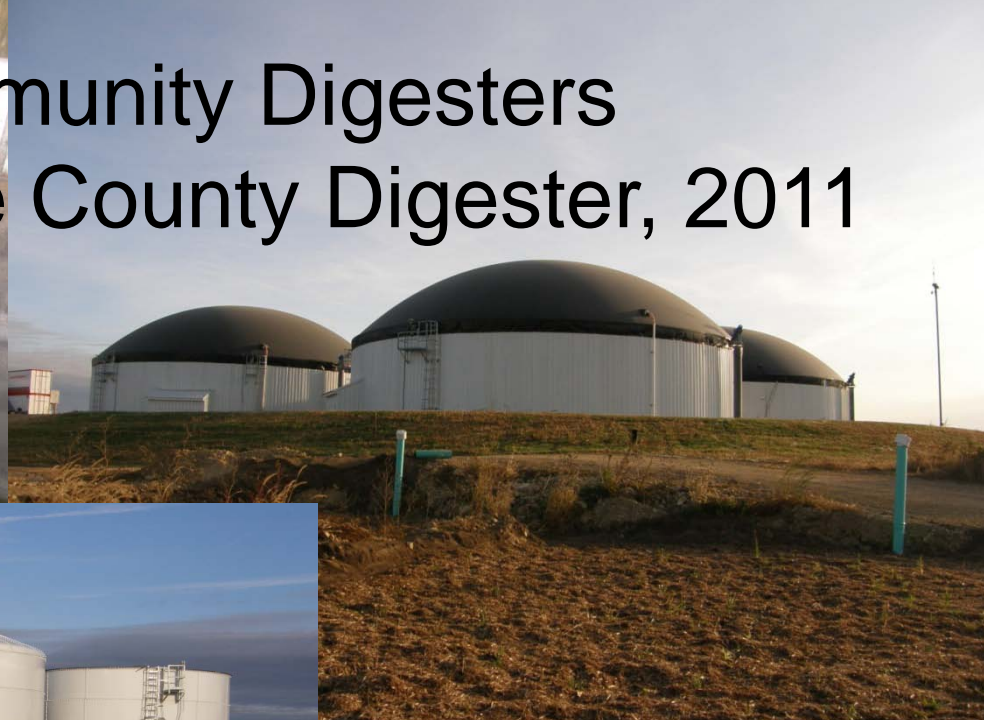
OshKosh Dry Digester, BIOFerm

Small Scale Digesters



Community Digesters

Dane County Digester, 2011

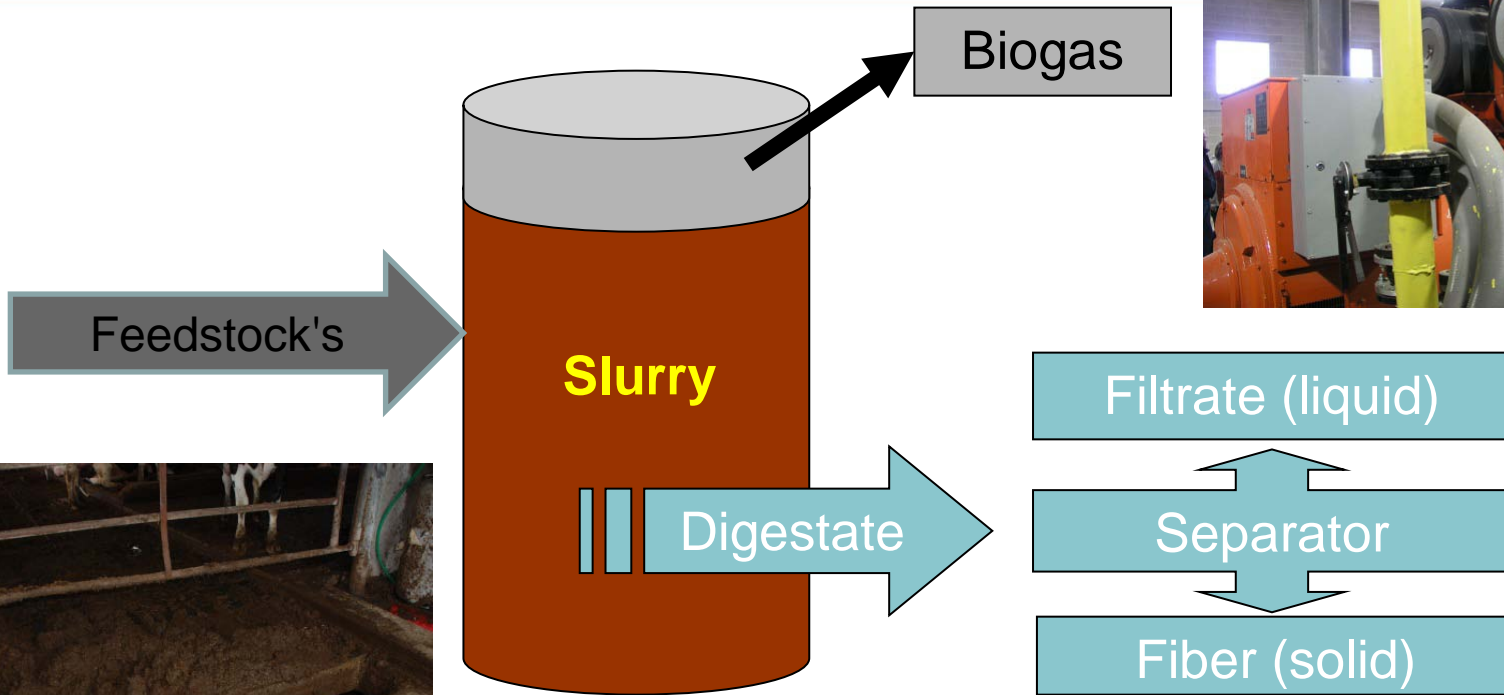


Agricultural Digesters

- 247 digesters in the U.S.
- 37 in Wisconsin
 - 35 different facilities
 - All dairy facilities
 - All liquid manure based systems
- ~300,000 metric tons CO₂ eq/year removal
 - Equal to:
 - ♦ 63,000 passenger cars, or
 - ♦ 322 million lbs of coal burned, or
 - ♦ 83 wind turbines
- 229 WI dairy CAFO (>1,000 Animal units) facilities
 - ~12% have digesters

Animals (No. of head)	Operational
< 1,000	9
1,000-2,000	9
> 2,000	19

AD Process Flow



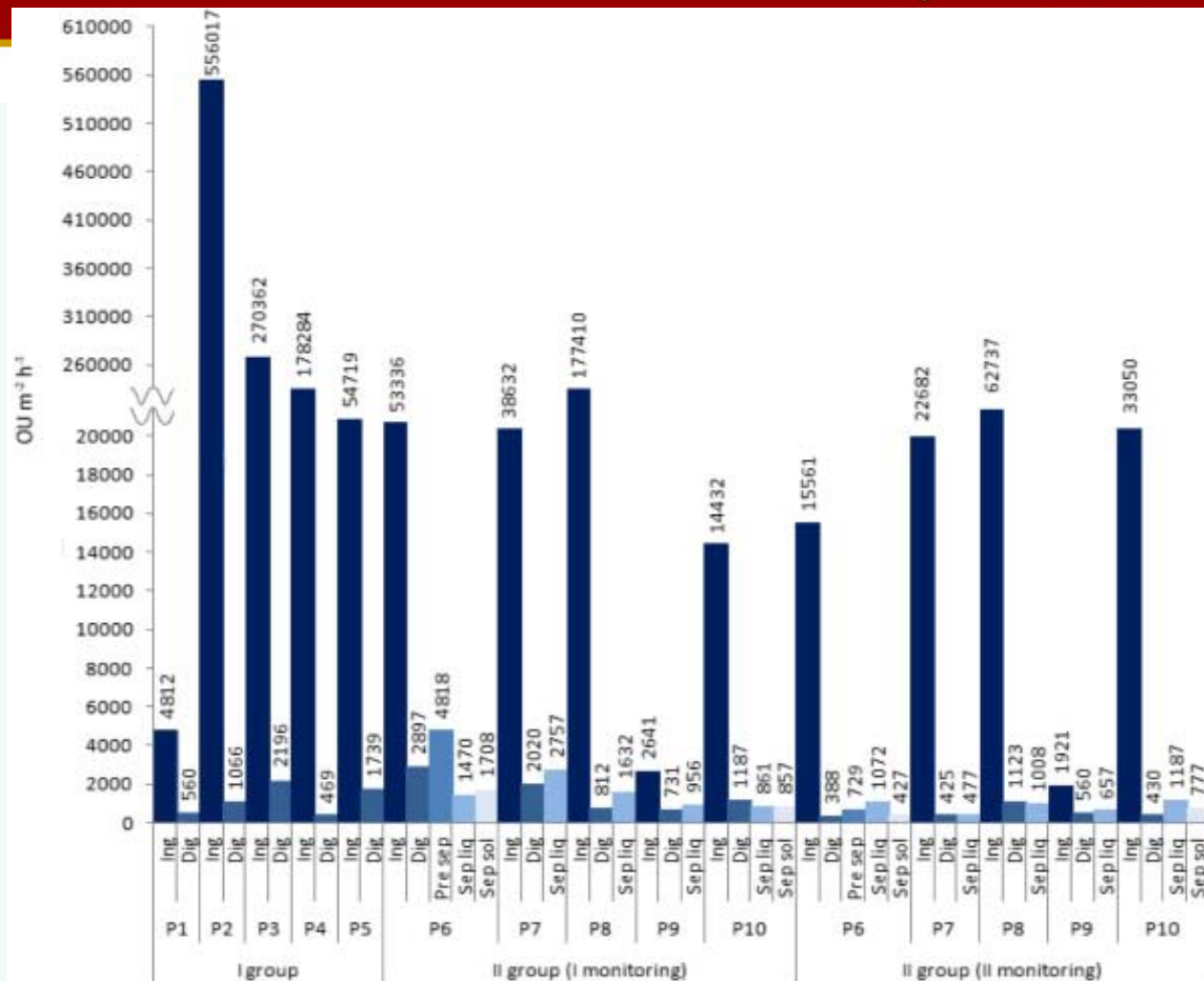
End Products



Swine Manure

(Hansen et al. 2006, Applied Engineering in Agriculture)

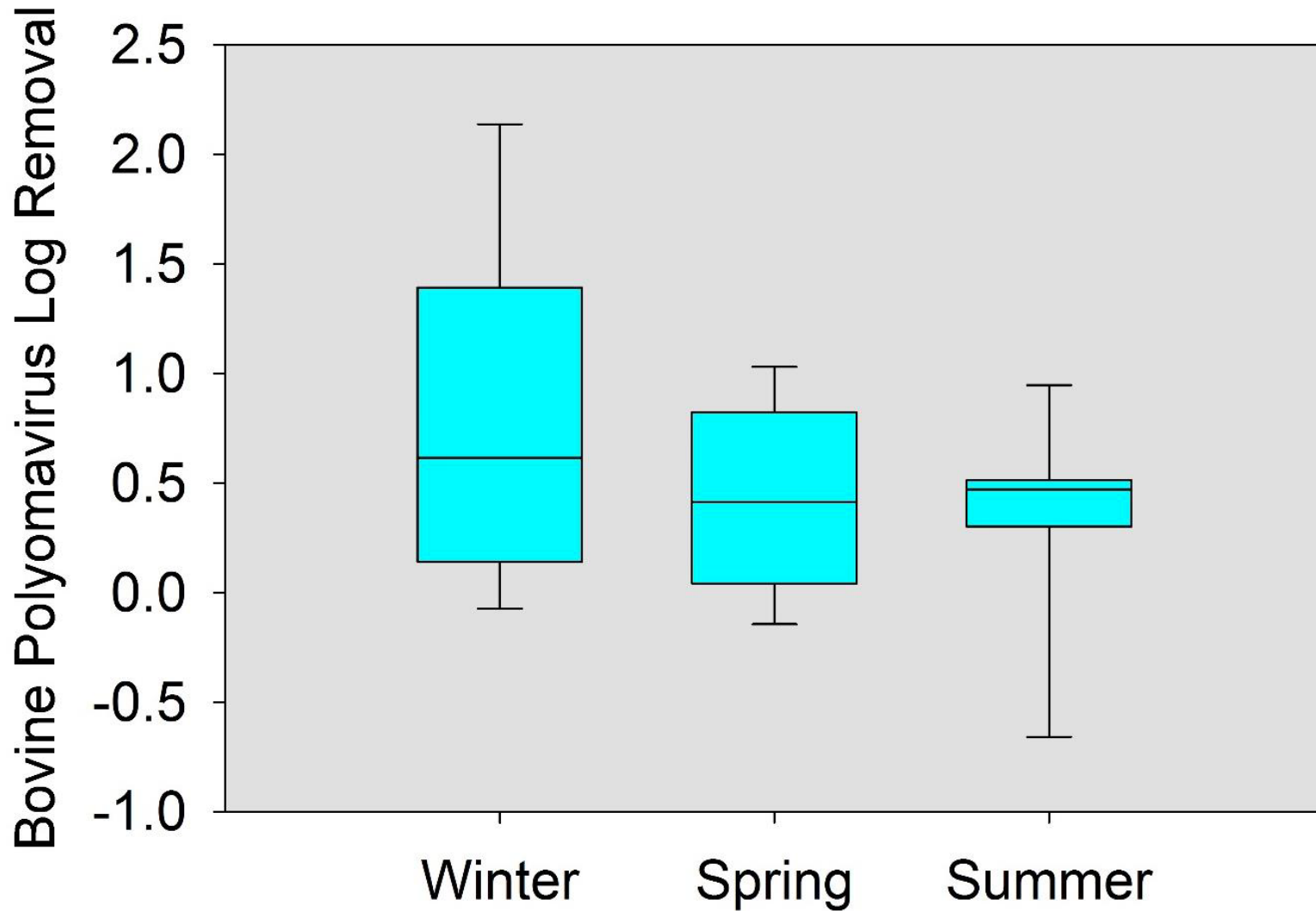
- Malodorous VFA reduced 79-97%
- Odor reduced above undisturbed slurry store reduced
- Land application odor reductions:
 - 17% AD
 - 50% AD + SLS



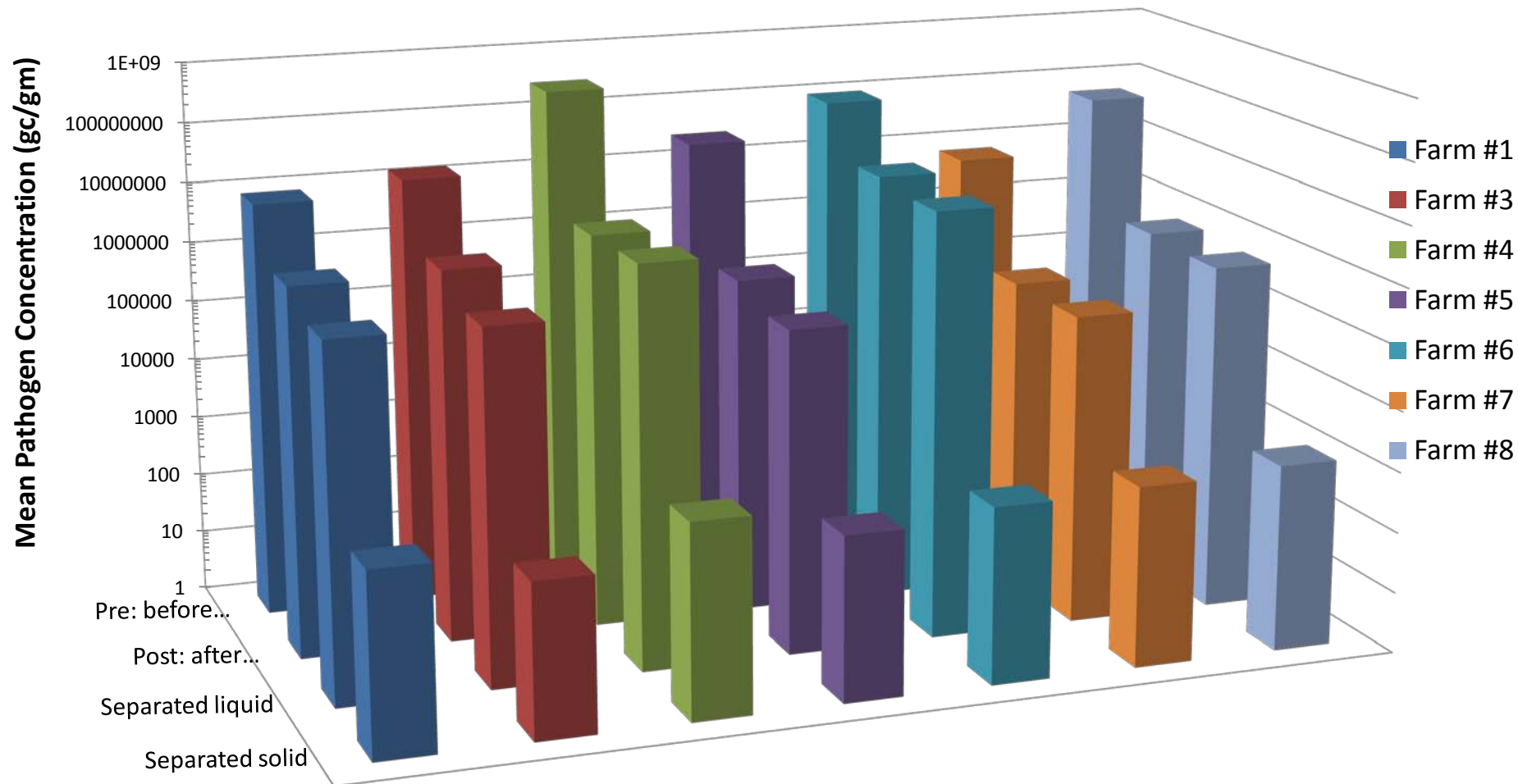
(Orzi et al., 2015, Science of the Total Environment)

- Odors reduced 98%

Bovine Polyomavirus

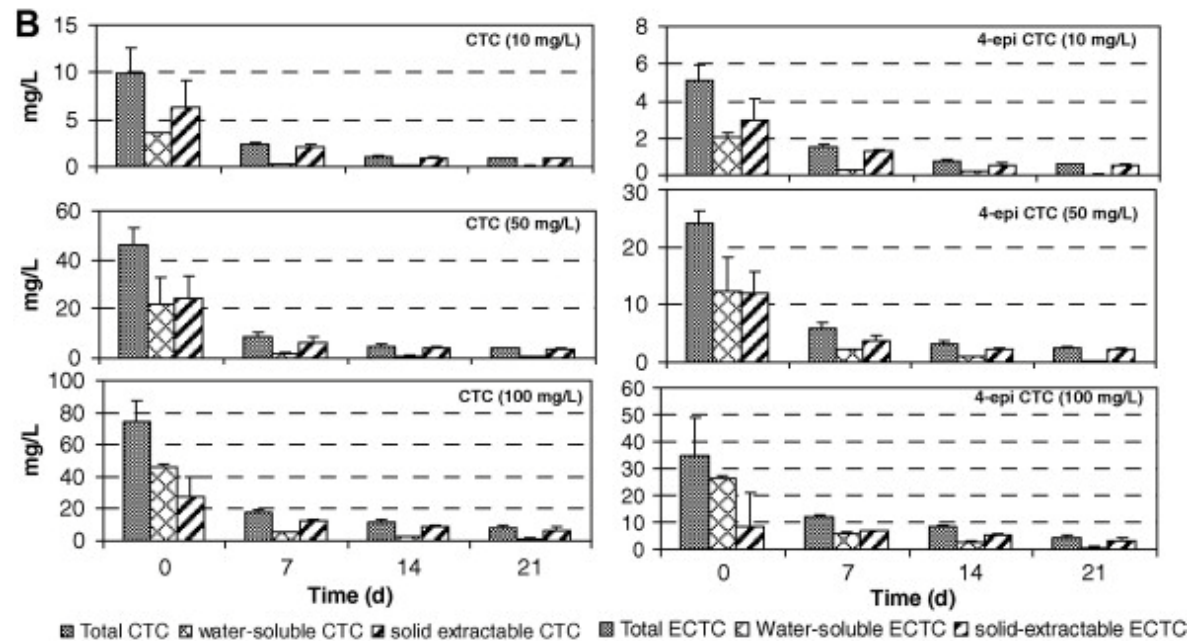


Bovine Polyomavirus



Antibiotic Degradation

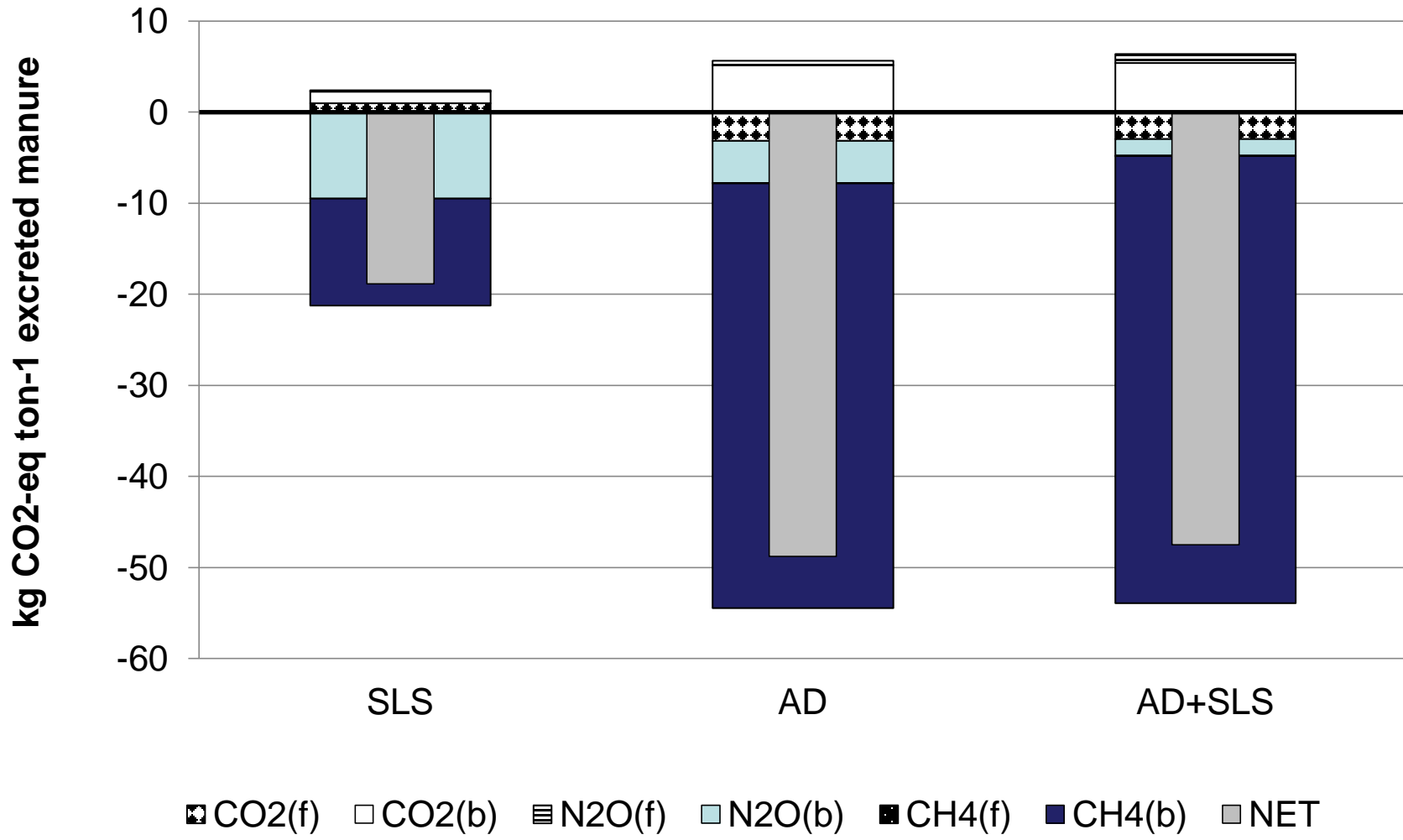
- Many antibiotics to be tested
- Not many studies to date
- May increase intermediates
- Beef manure studies by Arikan (2006, 2007, 2008) found some degradation in initial component, increases in some intermediaries



Alvarez et al., 2010, Bioresource Technology

- Fate of antibiotics in pig manure in AD
- oxytetracycline (OTC) and chlortetracycline (CTC)
- Reduction in antibiotics over time, as well as methane production
- Antibiotics adsorbed to solids increasing duration for destruction

Global Warming Potential



Thank You!



Biological Systems
Engineering

UNIVERSITY OF WISCONSIN-MADISON

LW
Extension
University of Wisconsin-Extension

