

Breakout session III: Finalizing Future Research, Education and Technology Transfer Activities

Truman Room
Group Facilitator: Matt Smith
Recorder: Thanh Dao
Reporter: Blaine Ferrell

Current Components:

- 1. Air Quality-Emissions**
- 2. Nutrients**
- 3. Pathogens**
- 4. Byproducts-Energy**

Alternate Components:

I. MANURE:

- 1. Public Health**
- 2. Environment**
- 3. Byproducts**
- 4. Energy**

II. BYPRODUCTS

- a. Industrial**
- b. Agricultural**

NEW COMPONENTS

I. PUBLIC HEALTH - (PRIORITY A)

- a. Fate & Transport, Pathogens/PAC –
- b. Risk Assessment, Pathogens/PAC. Propose safe levels A-1
- c. Control A-2

Air Quality

Odors (a,b,c)

Particulates

Gases

Mercury and trace metals A-3

Pesticides

Other contaminants (xenobiotics)

Phytoremediation

II. BYPRODUCTS (Industrial/agriculture/municipals) (PRIORITY B)

- a. Application rates
- b. Productivity Appropriate soils/crops..... B-1
- c. Prioritization B-2
- d. BMPs
- e. Innovative uses
- f. As animal feed
- g. New Equipment/Mechanization
- h. Ag. Residuals
- i. Energy Potential

III. ENERGY (PRIORITY C)

- a. Manure to energy
 - i. Co-digestion
 - ii. Thermochemical conversion C-1
 - iii. Optimized Systems C-2
 - iv. For producing energy crops (Manure & byproducts)

IV. NUTRIENTS (PRIORITY D)

- a. Fate and transport
- b. Management
- c. Feeding (New feeds for managed nutrient output) D-1
- d. Ammonia gas

LaDue Room
Group Facilitator: Andy Cole
Recorder: Bob Matteri
Reporter: Guy Hall

1) **AIR QUALITY***

- **GHG EMISSIONS – METHANE, N₂O (LINKED WITH NH₃)***
 - Monitoring and BMPs
- **ODOR/ AROMA***
 - Emission control, detection (sensory methods)
- Fate and transport
- Indirect emissions
 - NH₃ (N₂O)
- Determine management/ housing system impacts on emissions
 - How do management/ housing system affect research results?
 - Need checklist of management variables to be assessed that impact emissions
 - Consistent set of information that can be integrated and utilized for BMPs

2) **NUTRIENT MANAGEMENT ***

- **P REMOVAL FROM MANURE ***
 - Feeding
 - Plant genetics – low-phytate, better P bioavailability
- N capture/retention
- Nutrient extraction & marketing
 - Fractionate and concentrate valuable nutrients
- Other
 - Don't "overload" producers – User-friendly, economical, practical technologies
 - Holistic system
- Uses of manure/co-products – Total use of nutrients
- Water Quality
 - Run-off control
 - Application methods and timing
- **WATER QUANTITY ***
 - Conservation and Re-Use

3) **PATHOGENS AND PHARMACOLOGICALLY ACTIVE COMPOUNDS***

- **FATE & TRANSPORT***
 - Source tracking

- **HUMAN & ANIMAL PATHOGENS ***
- Not just bacteria – viruses, protozoa, etc
- Antibiotic resistance

4) By-products (energy)

- Ethanol Co-products
 - Low P DDGs
 - New products
 - Toxin (aflatoxin)
 - Reduction
 - Alternate products from lower-quality corn (non-feed, industrial co-products)
- Manure co-products
 - Compost – bedding, fertilizer
- Direct burning of litter/manure
 - Use of residues
- Methane digesters
 - Increased efficiency and economics
 - Effects on air quality – GHG, NH₃, odor
 - Co-digestion
- Mortality management

5) **OTHER***

- Carcass utilization
 - Catastrophic
 - Routine
- **NUTRIENT MANAGEMENT THROUGH ECONOMIC FARM-SCALE AND LARGE-SCALE SYSTEMS, LOGISTICS AND TECHNOLOGIES ***
 - Economic/ systems modeling
 - Regulations included in model, as they drive system and economics

Clayton Room Report

Group Facilitator: Mike Cotta

Recorder: Kim Cook

Reporter: Kurt Landis

Key Areas:

Emissions

- Impact of diet on emissions
- Particulate matter reduction
- Control while maintaining quality for use
- Control technology
 - Exhaust fan
 - Facility differences
- Source of dust particles (potential control methods – diet)
- Greenhouse gases (identify, control, remediate)
 - Lifecycle analysis (production and use)
- Odor methods to capture/sequester (also toxic emission)
- Sequester all gases (methods)
- Methanol, VOC, GHG, PM 2.5, PM10

By-products

- Standard methods of characterization of these materials (e.g. DGGs)
- Measures of beneficial effects of use addition/or not solely linked to yield
- Optimize nutrient use in by-products
 - Formulation software to most efficiently use
- Optimize conversion of nutrients in by-products to consumer preferred products

Nutrients

- Application technologies (machine)
- Heavy Metals (Fate)
 - What happens over lifetime (Arsenic)
- Fractionation of manure nutrients (P, N, etc)
- Impact of diet on organic fertilizer composition
- Crop rotation (especially with regard to new varieties)
- Application methods (timing)
- Capturing nutrient value (reduce emissions and other losses)
- Impact of increased byproduct use on manure nutrients
- Capture and re-use of water (clean up technologies)
- Capture carbon (credit) value of manure and by-products

Pathogens

- Source identification (wildlife vs human vs animal agriculture)
- Fate and transport of pathogens
- Minimize/control output of pathogens and hormones from animals

Energy

- Exploit energy resource value of manure/by-products
- Economic conversion technologies for on-farm use
- Conversion of operation waste streams (e.g. plastic bags) as potential energy source.
- Animal mortalities – capture energy value
- Capture operation energy- heat energy from animals and their products. Can this offset energy costs.

Top Priorities:

- **Energy:** Exploit energy resource value of manure/ by-products & capture operation energy – heat energy of animals – can this be captured to off-set energy costs
- **By-products and CO-PRODUCTS:** Optimize conversion of nutrients in by-products to consumer preferred products
- **Pathogens:** Fate and transport of pathogens
- **Greenhouse gases** (identify, control, remediate)
 - Lifecycle analysis (production and use)
- **Nutrient** - Application technologies (machine)

Lindbergh Room B
Group Facilitator: Allen Torbert
Recorder: April Leytem
Reporter: Mark Risse

Nutrients

- *Cost effective separation and extraction techniques
 - need better solid separation techniques
 - need cost effective methods for nutrient extraction (N, P, K)
 - need techniques to stabilize N in manures to capture value

- *Optimize use of manure nutrients as fertilizer
 - application rates and timing
 - need tech transfer to organize data that has been generated to develop use guidelines
 - application techniques
 - effects of manure application on carbon content of soils (organic matter)

- *Transportation technologies
 - volume reduction

Diet modification to influence nutrient content

- improve retention of N and P
- improve dry matter digestibility
- strategies to alter diets to reduce emissions

Nutrient source tracking

Evaluation of new feeds and environmental impacts

Emissions (NH₃, GHG, VOC, PM, volatile sulfurs and phenolics)

- *Understanding the efficiency of mitigation measures
 - How on farm management practices affect emissions

- *Accurate quantification of emissions on a source by source basis on production facilities

- *Developing air emission process models for each species (for all farm components)
 - have accurate emission factors for different production facilities that address all aspects of production and how it effects overall emissions

Reducing odors from production facilities and manure handling/land application

Bioaerosols

Develop standard methodologies/protocols for emissions measurements

Pathogens (both human and animal) and PACs (bacteria, viruses) in both air and water

*Source tracking

Direct measurement of pathogens
-develop improved indicators

*Fate and transport (air and water)

*Efficacy of BMPs
-for confined and non-confined animal operations

Develop standard methodologies/protocols (sampling and analytical)

Byproducts

*Risk assessment
-Fate and transport of pollutants

*Agricultural use

*C credit

Industrial wastewaters re-use

CCPs

Biosolids

Energy production byproducts (char, glycerin, etc.)

Water treatment residuals

Energy

*Manure to energy
-not just methane digestion

On farm research

Unintended consequences (e.g. NOx)

Economic models/analysis for different energy technologies

- process cost to guide research
- on farm evaluations

*Manure management strategies to reduce energy use

*Carbon footprint

- Tool

*****Holistic systems approach**

- greater concentration on economic evaluation
- tech transfer

Lindbergh Room A
Group Facilitator: Dan Miller
Recorder:
Reporter: Ray Campbell

Cross cutting issues:

Integrated components (these are for long-term considerations as part of strategic plan): baseline, background measurements of nutrients, gas emissions, pathogens, hormones. Recognize effects/impact on multiple components (whole system research). Conceptual models linking nutrients, emissions, pathogens for long-term sustainability.

Components

Emissions

1. identify and quantify the sources of greenhouse gases.
2. Research to mitigate/control of greenhouse gases e.g. NH₃, H₂S VOCs PM.

Nutrients: N, P, K, metals, separate (extract and concentrate) these from the waste stream. Need to control N especially N transformations, rates of transformation, understand how to stabilize transformations. Effect of buffer strips for surface water for surface water protection. Economic impact of manure as a fertilizer. Zn, Cd As in manure applications regarding regulatory issues. Develop risk assessment tools for P and N. Quantify benefits of manure applications, e.g. benefits of hummus; chemical components of feed relative to the heavy metals.

Summary:

1. better understand riparian zones and filter strips (land area management and nutrient flow, phyto availability).
2. Manure processing: innovative applications, storage, extraction and concentration of nutrients; long-term assessment of management practice, and large-scale studies, ie., watershed-scale.
3. Microbial mechanisms: understanding control of nutrient transformations.
4. Better methods for nutrients; standard methods.
5. Economic value of manure, nutrients and soil quality.

Pathogens:

1. Baseline, background values.
2. Source tracking of pathogens and hormones. Identify and quantify sources.
3. Fate and transport, water, food, air, bioaerosols.
4. Develop collaborations with public health scientists.
5. Emerging pathogens.

Byproducts:

1. Residues of energy production, food processing, pulp and paper, value added products from manure stream.

2. Alternative uses of manure: For feed, soil other. Will need risk assessment analysis.