Welcome to Manure Du Jour – Season II

Serving Pennsylvania’s Best Practices for Animal Ag-, Air- and Water Quality Protection

Innovative Technologies for Manure Application and Manure Expo 2010 Preview

Dr. Pete Kleinman, USDA ARS Pasture System & Watershed Management

Robb Meinen, Penn State Dairy & Animal Sciences

Moderator: Kristen Saacke Blunk
Penn State Agriculture & Environment Center
Manure Du Jour

April 15, 2010

Peter Kleinman
USDA ARS Pasture System & Watershed Management
Advances in manure application for the Chesapeake Bay Watershed

Peter Kleinman
Pasture and Watershed Lab
USDA-ARS
University Park, PA

Curtis Dell
Pasture and Watershed Lab
USDA-ARS
University Park, PA

Doug Beegle
Dept. Crop and Soils
Penn State
University Park, PA

Arthur Allen
Dept. Agriculture
Univ. Maryland Eastern Shore
Princess Anne, MD
Manure trade-offs: To till or not to till?

- No till increases N volatilization
- Tillage increases erosion P loss
- No-till increases soluble P loss
- Tillage reduces odor
- No-till increases leaching losses

Chesapeake Bay Loads

Urban/In-stream 60% “Natural” sediment Agriculture

manure incorporation benefits of no-till
Getting manure off the surface without resorting to full blown tillage

Liquid manure applicators
- Aeration
- Disk injection
- Pressure injection
- Anti-leaching sweeps

Dry manure applicators
- Solid injection
- Subsurface applicators
Equipment for perennial forages

- Sleigh foot
- Eco slit
- Trailing shoe
- Trailing hose
- Shallow injection
- Aerator
- High pressure
Liquid manure application trials – no-till corn

Rock Springs, PA

Princess Anne, MD

Broadcast

Tillage

Aerator

Shallow disk

Anti-leaching sweeps

High pressure

PDA, USDA-CIG, PA Pork Producers grants
Shallow disk injection

6000 gal/ac

30 in (adjustable)

4 in

Shallow Disk
High pressure injection

6000 gal/ac

6 in

3 in

10 in

3 in

High Pressure
Aerator w/banded manure

6000 gal/ac

No manure

Aerator

6 in

3 in
Aeration variations

Banded Manure After
Aerator at 0° angle

Banded Manure After
Aerator at 10° angle

Straight Manure Before
Aerator at 0°

Angled Manure Before
Aerator at 10° angle

Courtesy T. Myers, Penn State
Rock Springs Trials (2006-2007 average)

Residue cover (%)

0 25 50 75 100

No manure  Chisel Plow  Pressure  Disk  Aeration  Surface

Manure
Rock Springs Trials (2006-2007 average)

Data courtesy C. Dell, USDA-ARS
Ammonia: more manure on the surface, more ammonia emitted

Dairy manure (6,000 gal/ac)

Manure on soil surface (mg/m²)

Ammonia emission (kg/ha)

Data courtesy C. Dell, USDA-ARS
Phosphorus: more on the surface, more dissolved phosphorus in runoff
Economics

Integrated Farming Systems Model

Data courtesy A. Rotz, USDA-ARS
Manure discharges to tile lines
Macropore flow

Photos courtesy M. Shipitalo, USDA-ARS
DSI Ag’s Preferential Flow Stopper

- **Flow splitter**
- **Tillage wings**

**8,000 gal/ac**

- **Splitter ensures even distribution of slurry across furrow, lower vertical pressure**
- **Wings mix slurry with soil**
- **Mixing breaks macropore connection**
Tillage and leaching losses (first 8 months after liquid swine manure application, 2008)

Total P loss in leachate (lbs/ac/yr)

- No manure
- Shallow injection
- Anti-leach sweeps
- Surface application

Chronic transfer of P from surface soil
Solid/semi-solid technologies (2005)

Prairie Machinery Institute

Booneville, AR (ARS)

Auburn, AL (ARS)
Prairie Ag Machinery Institute

Flexible augers
Generation 1: ARS’s Auburn litter applicator

Photos courtesy T. Way, USDA-ARS
Generation 1: ARS’s Auburn litter applicator

- No-till disk
- Litter chute
- Trencher
- Closing disks
Application rate: <1 to 8 tons/acre

Variable row spacing

- 10-40”
- 4-10 injectors

4” open trench (closing disks raised)
Subsurface application of dry manure in no-till and perennial forage soils

NOAA CICEET Grant

Generation 1 Subsurface applicator
Two generations of technology

Generation 1

Gen 2 (the Subsurfer)
Change in furrow spacing and litter delivery system

Generation 1
- Hopper
- Belt delivery

Gen 2 (the Subsurfer)
- Wagon
- Auger delivery

30 in (variable)

12 in
Chesapeake Stewardship Fund Project

Nutrient and Sediment Reduction Grant
(USDA-ARS, Penn State, Univ. Delaware, Univ. Maryland, Virginia Tech, Cornell, Baron & Bros. Int.)
Adapt ARS’s “Subsurfer” to the conditions of the Chesapeake Watershed

Build 4 Subsurfers (PA, NY, VA, MD/DE)
1. assess agronomic/environ. performance
2. engineering revisions by BBI Inc.
Equipment Costs

• **Liquid (12’ toolbar)**
  - Shallow disk ($9,000)
  - Aeration ($18,000+$5,000 chopper)
  - High pressure ($25,000)
  - Anti-leaching sweeps ($9,000)

• **Solid**
  - Subsurfer ($44,000 custom build)
Alternatives to broadcasting manure in no-till

- slower
- require more horsepower (up to 30%)
- equipment costs more
- contract application with injectors costs more
- Greater nutrient use efficiency = lower application rates
Manure nutrients = sustainable livestock agriculture

US Ag > 50% N imported

Global P sources

China
Trinidad and Tobago
Middle East
Russia
Canada

US Ag > 80% K imported

Belarus
Canada

Cordell et al., 2009
Executive Order 13508 and 2010 Chesapeake Bay TMDL

**Agric. Fertilizers**
- Urban/Suburban: 19%
- Wastewater: 18%
- Forests: 18%

**Agric. Manures**
- Urban/Suburban: 27%
- Wastewater: 18%
- Forests: 18%
Summary

• Improved application of manure can increase nutrient use efficiency and lower environmental losses
• New technologies are emerging
• Need to account for site-specific concerns
  – Manure application involves trade-offs
2010 Manure Expo

Balancing Production and Conservation

Thursday, July 15

Ag Progress Days Fairgrounds
Pennsylvania Furnace, PA

http://das.psu.edu/manure-expo
ManureExpo@psu.edu; (814) 863-2873
Robb Meinen, Expo Chair, rjm134@psu.edu
Manure Du Jour

Robb Meinen
Penn State Department of Dairy & Animal Sciences

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What is the Manure Expo?

- Founded in Wisconsin in 2001 by request of the commercial manure application industry.

- The industry wished for a venue where they could conduct side-by-side technology demonstrations and “kick the tires”.

Wisconsin, 2001 – Humble beginnings would grow with good reason.
3 goals

*The Expo combines 3 attractions into 1 event.*

1. Industry trade show.
2. Manure technology demonstrations.
3. Educational events.
Local – Regional – National

Wisconsin, 2003

Spill Response Demo planned for 2010 as well.
Minnesota, 2005

Indoor presence grows.
Michigan, 2006

Hosted by Berlyn Acres
Fowler, Michigan
July 27, 2006

Don’t miss this important event! See the schedule in the center of this publication.

- Information-packed in-field equipment demonstrations
- Valuable educational sessions
- More than 60 commercial vendor displays
- 4 CCA credits available
- Lunch available on site

Level II credits available to for-hire manure applicators participating in the voluntary certification programs in Illinois, Indiana, Michigan, Ohio and Wisconsin.

www.rootzone.msu.edu

1,500+ Attend
Wisconsin  “MANURETECH 2007”
Ohio, 2008

The Economics of Recycling
IOWA STATE UNIVERSITY and the Iowa Commercial Nutrient Applicators Association Presents:

July 22, 2009
2009 Upper Midwest Manure Handling Expo
SET for Fall
Safety, Efficiency & Technology
Central Iowa Expo Center- Boone, Iowa

Vendor, Demonstration and Sponsorship Opportunities are now available for the 2009 Expo.
For additional information visit the Expo Web site.

515-294-3153  agwaste@iastate.edu
http://www.ag.iastate.edu/wastemgmt/expo_home.htm
Pennsylvania, 2010

*Expert presenters from:*

- Penn State
- Virginia Tech
- U of Maryland
- U of Delaware
- Cornell
- U of Maine
- USDA ARS
- More…
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<th>Time</th>
<th>Session 1</th>
<th>Session 2</th>
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<th>Session 4</th>
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<td>Dry Equipment Demonstrations</td>
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2010 Manure Expo – Agenda

- Manure application in…
  - No-till
  - Alfalfa/Legumes
  - Cover Crops
- Winter application
- Spreader calibration
- Manure application odor
- Soil compaction
- Regulations/Ches Bay policy
- Nutrient trading & innovative community projects
2010 Manure Expo – Agenda

- In-house poultry litter mgmt
- In-field storage of manure
- Manure mgmt & flies
- Using dairy solids as bedding
- Alternative treatments of manure
- Mortality composting
- Spill response & safety
- Tours & more…
  - PA One Stop workshops
  - Soil Pit
  - Sinkhole tour
2010 Manure Expo
Balancing Production and Conservation

Please “spread” the word.
Please attend.

July 15, 2010
Ag Progress Days site

Please visit our website:
http://das.psu.edu/manure-expo

Robb Meinen
(814) 865 – 5986
rjm134@psu.edu
Question and Answers

• Recordings of this session will be posted at www.aec.cas.psu.edu
What’s ahead for season II?

• Next Manure du jour
  – April 22, Linking Livestock & Renewable Energy
    • Dave Dunn, Cow Power Coordinator for Central Vermont Public Service
    • Paul Patterson, Penn State Poultry Science

• Full schedule for the Manure du jour program: http://aec.cas.psu.edu