The Impact of Manure Management and Cover Crops on Drainage Water Quality and Yields

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Overview

• Why use manure and cover crops?
• Research site and drainage system design
• Present preliminary data from 2016 - 2017
  ✓ Precipitation and drainage
  ✓ Drainage water quality
  ✓ Cover crop N uptake
  ✓ Yields
• Conclusions
Benefits of livestock manure

• Less need for purchased fertilizers
• Add micronutrients to soil
• Improve soil health
  ✓ Increase soil organic matter
  ✓ Improve porosity & aggregate stability
  ✓ Reduce soil bulk density
  ✓ Increase microbial activity & nutrient cycling
Top 10 (+2) reasons to use a cover crop

1. Reduce erosion
2. Increase soil organic matter
3. Feed soil biology
4. Build resiliency to extreme weather
5. Increase soil water holding capacity
6. Increase infiltration rate
7. Provide weed control
8. Reduce compaction
9. Opportunities for grazing
10. Help with manure management
11. Cut fertilizer costs?
12. Improve yield potential and profit over time?
Drainage water quality research site

Northeast Research and Demonstration Farm Nashua, IA (NERF)

- Thirty-six 1 acre drainage plots with water quality monitoring system
Plot design

Plots are isolated with tile and berms to prevent cross-flow

Schematic of the drainage plot setup
Drainage system design

Drainage water quality monitoring system installed in 1998

- Flow meter for collecting flow volume data
- Flow-proportional passive sample collection

Schematic of the meter and water sample collection sumps

Drainage water collection sumps at Northeast Research and Demonstration farm
Management systems for 2016 - 2018 study

<table>
<thead>
<tr>
<th>System</th>
<th>Application timing and N source</th>
<th>Crop</th>
<th>Tillage</th>
<th>N rate (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spring UAN</td>
<td>Corn Soybean</td>
<td>Chisel plow Field cultivate</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>Early fall manure</td>
<td>Corn Soybean</td>
<td>No-till No-till</td>
<td>150</td>
</tr>
<tr>
<td>3a</td>
<td>Late fall manure + Instinct</td>
<td>Continuous corn</td>
<td>Chisel plow</td>
<td>200</td>
</tr>
<tr>
<td>3b</td>
<td>Spring manure</td>
<td>Continuous corn</td>
<td>Chisel plow</td>
<td>200</td>
</tr>
<tr>
<td>4a</td>
<td>Late fall manure</td>
<td>Continuous corn</td>
<td>Chisel plow</td>
<td>200</td>
</tr>
<tr>
<td>4b</td>
<td>Late fall manure + 1 ton/ac gypsum</td>
<td>Continuous corn</td>
<td>Chisel plow</td>
<td>200</td>
</tr>
<tr>
<td>5</td>
<td>Early fall manure</td>
<td>Corn + Rye cover Soybean + Rye cover</td>
<td>No-till No-till</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>Late fall manure</td>
<td>Corn Soybean</td>
<td>No-till No-till</td>
<td>150</td>
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</tbody>
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Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Precipitation and drainage

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Monthly nitrate-N levels in corn
2016-2017

Flow-weighted nitrate-N concentration (mg/L)

- 1 CP Spring UAN 150lb N/ac
- 2 NT Early fall manure 150lb N/ac
- 5 NT Early fall manure 150lb N/ac + cover crop
- 6 NT Late fall manure 150lb N/ac

Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Cumulative nitrate-N losses from corn 2016-2017

Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Monthly nitrate-N levels in soybeans 2016-2017

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Cumulative nitrate-N losses from soybeans 2016-2017

Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Monthly nitrate-N levels in continuous corn 2016-2017

Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Cumulative nitrate-N losses from continuous corn 2016-2017

Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Cereal rye cover crop N uptake

Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Manure injection bands

Manure injected on 30” spacing with Houle 3350 gal. manure tank
Manure injection bands

Rye cover crop growth at NERF April 6, 2016
Corn phase yields

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Soybean phase yields

- Soybean phase yields for the years 2016 and 2017 are displayed in the bar chart.
- The yields are measured in bushels per acre (bu/acre).
- In 2016, the yields are 1 Chisel plow: 60 bu/acre, 2 No-till: 60 bu/acre, 5 No-till + cover crop: 50 bu/acre, and 6 No-till: 72 bu/acre.
- In 2017, the yields are 1 Chisel plow: 55 bu/acre, 2 No-till: 52 bu/acre, 5 No-till + cover crop: 59 bu/acre, and 6 No-till: 60 bu/acre.

Research funded by Iowa Pork Producers Association and Calcium Products Inc.
Continuous corn yields

*3a was planted to soybeans in 2015

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Preliminary conclusions 2016-2017 study

From a drainage water quality standpoint:

➢ Spring is better than fall manure application
➢ Late fall is better than early fall manure application
➢ No-till won’t necessarily improve drainage water quality
➢ Cover crops reduce nitrate-N levels and overall N losses

From an overall management and economic standpoint:

➢ It’s complicated
➢ Weather (timing, compaction) & economic considerations
➢ Cover crops take management - timing issues, yields?
Thank you!

Questions?