Addressing Economic & Environmental Risks While No-Tilling

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Addressing Economic & Environmental Risks With Healthy Soil

Optimizing Soil Production!

2012
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NRCS
We need to build a better Cropping System

Why Now!

• Economic Efficiency
• Water Efficiency
• Nutrient Efficiency
• Energy reduction
• Reduce Risk
  – Catastrophic weather
  – Environmental Regulation
LOSS OF SOIL HEALTH

Lake Erie = sediment and algae plumes 2011

Lubbock, Texas 2011 = particulate matter

Mississippi River Watershed Flood 2011 = flood damage, sediment and nutrients
Can we increase production without sacrifice to our natural resources?

No-Till/Strip-Till (continuous/quality)

Nutrient Management (Advanced/ 4Rs)

Cover Crops (smart mixes)

Buffers (Farm where you can, but buffer where you should)
Multicounty corn yield history chart

National Agriculture Statistics Service (NASS)
Slake And Infiltration Demonstration

System Comparisons

Conservation Tillage
Continuous No-Till + Cover Crops
Conventional Tillage
Conservation Tillage  No-Till  Continuous No-Till + Cover Crops
Relentless Pursuit of High Soil Health
Key characteristic: Soil Microbial Diversity (Soil Biodiversity) biodiversity = most valuable property of any ecosystem  [E.O Wilson, 1999]

Greater Biodiversity => Greater range of pathways for primary production and ecological processes (i.e., nutrient cycling); alternative pathways available if one is disturbed  [Bob Kremer- Prof. of Soil Microbiology, University of Missouri]
Conservation Cropping Systems

Soil Quality - functional ability of soil to support optimal biological activity and diversity for plant and animal productivity, to regulate water flow and storage, and to provide an environmental buffer

Soil Health: continued capacity of soil as a vital living system whereby plant and animal growth and environmental quality is sustained; a holistic approach in which plant, animal, and human health is promoted
Conservation Cropping Systems
Fully Functional No-Till = High Soil Health

Resilience!
Carbon and Nitrogen Cycles Need to be Managed on a Broad Scale

General Rule of Thumb- Grow and sequester as much carbon as we remove or burn.
The Key is to Manage the Fate of Nitrogen

Nitrogen transformations

- Urea-N → NH₄⁺ (hydrolysis)
- Organic-N → NH₄⁺ (mineralization)
- NH₄⁺ → NO₃⁻ (nitrification)
- NH₄⁺ → NH₃ (volatilization)
- NO₃⁻ → N₂, N₂O, NO (denitrification)
- NH₃ (immobilization)
- Leaching
Nitrogen Management

Nitrogen cost-

• Can be the Single highest input cost for corn production

• 30% loss can be expected from early application
Nitrogen Management

- Nitrate mineralized from crop residues and soil OM is highly soluble through the winter.
- N Leaching can exceed 50 lb/ac. with no fall application.
- Every effort should be made to capture this N.
Conversion of $\text{NH}_4^+$ to $\text{NO}_3^-$ in agricultural soils

<table>
<thead>
<tr>
<th>Temp., °F</th>
<th>Days to $\text{NO}_3^-$</th>
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<tr>
<td>35</td>
<td>263</td>
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<tr>
<td>45</td>
<td>53</td>
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<td>60</td>
<td>12</td>
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<td>9</td>
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<td>80</td>
<td>6</td>
</tr>
<tr>
<td>95</td>
<td>4</td>
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Corn planted on May 1\textsuperscript{st} will use only 35# N by June 15th
Nitrogen loss costs (@ $.70/lb N)
Leaching-$35/ ac.
Denitrification (June, 2010)- $ 21/ ac.
Immobilization? Can be high.
What about Yield Loss?- $45+/-
Phosphorus Management Strategies

Manure?

North Dakota Manure Management
Phosphorus Management Strategies
Among the No-Till/Strip-Till Pros

• Improve soil health to increase water infiltration, aggregate stability, functional mycorrhizal communities and improve P availability to crops.
• Avoid application to frozen soils
• Minimize the loss of crop residues. Establishing a cover crop, leaving higher stubble heights, avoiding detachment and excessive chopping
Phosphorus Management Strategies Among the No-Till/Strip-Till Pros

- Tolerate 0 soil erosion
- No-Till should be “Never-Till”
- Adopt soil management zones and apply only where needed
- Cover Crops should be prescribed mixes that address the resource concern
- Adopt smarter drainage systems
Phosphorus Management Strategies Among the No-Till/Strip-Till Pros

• Most attempt controlled traffic
• Use Floatation or tracks on grain cart
• GPS Guidance and Automation
• Most pay attention to nutrient balance and placement
• Feed the soil and let the soil feed the crop
Farmers will need to reinvest $$ in New Conservation Systems +

Precision Tech.

Advanced planting systems
Cover Crop Benefits in Drought

2005 Illinois Corn Data (2.3 inches rain)
Conventional tillage  82
No-till  124-82=42 bushels * $5/Bu = $210
No-till + Annual Ryegrass 137-82=55*$5 = $275
$275/20 years  $14 per year
Productivity of SOM

• Michigan study: Every 1% SOM = 12% increase in crop yields.
• Baseline Yields: 170 bu corn, 50 bu soybeans
  Starting SOM = 3% and add 1% SOM

Soybeans 50 bu * 12% = 6 bu * $10 = $60/A.
  .1 to .15% SOM increase/year = $6-$9/yr.

Corn 170 bu * 12% = 20.4 bu * $5 = $102/A
  .1 to .15% SOM increase/year = $10.20-$15.30/yr.
Water Storage Value

- Every 1% SOM hold 1 acre-inch of water
- Value of an acre-inch of water = $12
- Value of 6% SOM vs 2% SOM =
  4 acre-inches of water * $12/acre-inch = $48
- .1% SOM addition per year =
  .1 acre-inch * $12/acre-inch = $1.2 per year
Manure Value of Cover Crops

Swine Manure: 95% Water 5% solids

Manure Nutrient Analysis: 18-16-14/1000 gallons

Uptake: At 5,000 gallons/A = 90-80-70 $33
At 10,000 gallons/A = 180-160-140 $44

*Absorb 70% N, maximum 20# P
Cropland Lease Agreements

Duties of the tenant:

• The tenant agrees:
  • To follow a conservation (No-till/Strip-Till) cropping system that does not degrade soil quality from: soil erosion, loss of organic matter, soil compaction and excessive tillage.
  • Cover Crops will be planted following low residue crops.
Pastureland Lease Agreements

Duties of the tenant:
• The tenant agrees:

• To follow a grazing management system that does not degrade soil quality from: soil erosion, loss of organic matter, soil compaction and over grazing.
Any Land Lease Agreements

Duties of the tenant:

• The tenant agrees:

• Protect Soil Resources according to a conservation system approved by NRCS

• Keep in good repair and preserve all established watercourses or ditches including grassed waterways; and refrain from any operation or practice that will injure such structures.
Duties of the tenant:

• The tenant agrees:

• To fertilize annually, based on Purdue University removal rates.

• *Maintain sustainable fertility at current or Medium based on Purdue University current recommendations*. Provide copies of soil test reports to landowner.
All Land Lease Agreements

Duties of the tenant:

• The tenant agrees:
  • To fertilize annually, based on Purdue University removal rates.
  • Maintain sustainable fertility at current or Medium based on Purdue University current recommendations. Provide copies of soil test reports to landowner.
Extended Leases Agreements

• Renewal for (5+) Crop Years 20________

• 1. Annual rent for crop year 20_____ shall be $____________payable on the same dates and in the

• same proportion as specified above.

• 2. All other agreements in this lease are hereby renewed for crop year 20_____.

Revenue Sharing
Leases Agreements

Incentive for improving Soil Health and Function

• % of Gross above____________________
• ???
Spread the due...
...the Residue
Spread the Weight!

Control Traffic
No-Till Equipment Series

planters, attachments, maintenance and adjustments
We should settle for nothing less than perfection no matter what the scale.
No-Till planter attachments

Reduced Inner Diameter (RID) Gage Wheel Tires

Density can vary...softer is preferred.
No-Till planter attachments

Reduced Inner Diameter (RID) Gage Wheel Tires-right side

Significantly reduces the weight directly over the see slot
Can we achieve 300 bu Corn and 100 bu Beans by 2030?

Conservation Cropping Systems
The 300 Bushel Focus

Management
• Water
• Fertility & pH
• Tillage
• Pest management
• Hybrid
• Plant population
• Planting date
• Row Spacing
• Crop Rotation
Can we achieve 300 bu Corn and 100 bu Beans by 2030?

U.S. Corn Yields, 1930-2030

Calculated:
1.87 bu/a/yr slope (30 yr)
1.24%

What If We Added Soil Health?
Common Practices Among the No-Till/Strip-Till Pros

**Controlled Traffic**

- Clay Mitchell, NE Iowa
- Only 17% of the farm gets driven on.
Row-to-Row yield benefits under controlled traffic and relay cropping (approximated)
Cover crop effects

No Cover Crop
80+/- bu/ac

6 years CC (annual ryegrass)
160+/- bu/ac

Healthy Soil Value = 80bu x $6.30 = $540/ac

Mike Plumer’s long term no till with ryegrass cover crops
Mastering the Details is Key to Optimum Production

“We can take production and conservation further with Conservation Cropping Systems”

Capture the potential!
Mastering the Details is Key to Optimum Production

“We can take production and conservation further with Conservation Cropping Systems”