HOW CHANGES IN NUTRIENT MANAGEMENT REGULATIONS WILL AFFECT FORAGE PRODUCTION

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Department of Soil Science
University of Wisconsin
What are the issues

- Forage producers typically have livestock (manure)
- USDA-NRCS Technical Standard 590
- Impact of conservation planning
- Improving nutrient management
- Incorporating new research
- What the future holds
Technical Standard 590

Criteria For All Sites

- “T” Shall Not Be Exceeded
- Follow UWEX Recommendations
- Establish Perennial Vegetation In Concentrated Flow Channels
- Manure Shall Not Be Spread In Concentrated Flow Channels
- Frozen/Snow-covered Ground:
  - MANURE SHALL NOT BE SPREAD W/In 1000' OF LAKES AND 300' OF STREAMS
  - MANURE SHALL NOT BE SPREAD W/In 200' UPSLOPE OF WELLS, SINKHOLES, GRAVEL PITS
  - Can’t Exceed Crop’s P Removal
  - Limit Liquid Manure To 7,000 Gal/A
  - Can’t Apply On Slopes > 9 % (Some Exceptions)
Erosion Is A Wisconsin Problem

- Degradation Of The Resource
  - Fertility
  - Organic Matter
  - Tilth

- Water Quality
  - Sediment
  - Nutrients

- Program Cost
  - Cheaper To Prevent
  - Expensive And Time-consuming

Near Blue River
Soil Erosion Effects On Environmental Quality And Productivity

- Loss Of OM, Clay, And Nutrients Reduces Productivity
- Damage To Plants
- Formation Of Rills And Gullies Affects Management
- Sedimentation In Waterways, Diversions, Terraces, Ditches
- Delivery Of Nutrients To Surface Water
The Water Erosion Process

DETACHMENT

DEPOSITION
Reduced Tillage Is The Farmer’s Best Conservation Tool

Twisted Shovel
Coulter Chisel Plow

No-till Soybean On Corn
Supporting conservation practices

- Contour strips – Crawford Co.
- Contour buffer strips – Chippewa Co.
- Contour terraces – Grant Co.
- Diversion and cover crop – Fond du Lac Co.
Technical Standard 590

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WHAT SOIL TESTING TELLS US

- Crop N need
- Plant available P and K
- Crop P and K need
- Soil organic matter
- Soil pH and lime requirement
- All locally calibrated
How Many Samples to Take

Responsive fields
Sample every 5 acres

Non-responsive fields

<table>
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<tr>
<th>SAMPLE NUMBERS</th>
<th>FIELD SIZE (ac)</th>
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<tr>
<td>2</td>
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<td>41 - 60</td>
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<td>6</td>
<td>61 - 80</td>
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<td>7</td>
<td>81 - 100</td>
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10 CORES/SAMPLE MINIMUM
TAKE MANURE AND LEGUME CREDITS

- **Forage Legumes**
  - Stand, Soil Texture, Fall Harvest Mgt.
  - Red Clover 80% Of Alfalfa Credit
  - Can Supply Full Corn N Need

- **Soybean**
  - 40 Lb N/A (No Credit On Sands And Loamy Sands)

- **Manure**
  - Varies By Animal And Handling
  - Typical Dairy Manure (3-4 lb N/TON OR 8-10 lb N/1000 Gal)
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Frozen/Snow-covered Ground:

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Concentrated Flow Channels Must Be Vegetated

“A Grassed Waterway Is A Beautiful Thing”

“Mother Nature-engineered” Waterway
Easy To “Forget” Waterways When Snow-covered
Technical Standard 590

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- Can’t Apply On Slopes > 9 % (Some Exceptions)
Winter Manure Application Considerations

- Avoid Steep Ground (> 6% Slope)
- Recent Research Shows More P Loss In Fall No-till And Less If Fall Chiseled
- Remember The Waterways And Setbacks When Applying To Snow-covered Ground
Technical Standard 590

Criteria For Groundwater Protection

- No Fall N Applications
  - Highly Permeable Soils
  - Shallow Soils (20” to Bedrock, 12” to Water Table)
- Irrigated Sands
  - Apply Majority Of N Sidedress
- Manure Application On Sands
  - If Soil > 50 F
    - Use A NI Or Apply Less Than 120 lb N/A
    - Apply After Sep 15 And Limit Rate To 90 lb N/A
    - Apply To A Perennial Or Fall-seed Crop At 120 lb N/A
  - If Soil < 50 F Limit To 120 lb N/A
- Specific P Leaching Considerations
Technical Standard 590

Criteria For Surface Water Protection

- Use Phosphorus Index To Rank Fields

  or

- Base Application On Soil Test P
  - < 50 ppm P: BASE ON CROP N NEED
  - 50 – 100 ppm P: CAN'T EXCEED REMOVAL FOR 4 YEAR ROTATION
  - > 100 ppm P: APPLICATION LESS THAN P REMOVAL
    - PLUS: > 30% RESIDUE or FALL COVER CROP or CONTOUR and/or BUFFER STRIPS

- Application In Non-frozen SWQMA's Require:
  - BUFFERS or >30 % RESIDUE or FALL COVER CROPS or INCORPORATION THAT MEETS “T”
The Wisconsin P Index

- Based on research results from runoff experiments
- Indicates potential of a field to deliver P to surface water
- Provides one option for P-based nutrient management planning
- Combines P input from soluble and sediment sources
The P Index shows the relative risk of different field management practices on the delivery of P to surface water.
P Index Values for Grant County Corn Field

Rozetta silt loam soil, 6% slope, Bray P=50 ppm

0-2=minimal risk; 2-6=acceptable; >6 adjust management
Technical Standard 590

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What Is A Riparian Filter Strip

- A Planted Or Natural Vegetative Buffer In The Area That Links Terrestrial And Aquatic Habitats

- Serves As:
  - Filter
  - Transformer
  - Sink
Filter Strip Function
- Filter Sediment
- Stabilize Banks
- Wildlife Habitat
Filter Strips Are A Living Silt Fence
Installing A Filter Strip (Sauk Co.)

Site Prior To Establishment
May, 1999
Following Clipping of Timothy/Brome August, 1999
Filter Strip Effectiveness
After 7 in. Rain
June, 2000
Ashwaubenon Creek Tributary, Brown Co. (Source: Bill Hafs)

Two years later

Before
What The Future Holds

- NMP Will Allocate Manure To More Acres On A Farm
- More Manure May Have To Be Applied On Erodible Land And To Fields Near Surface Water
- Rotations On Erodible Land Possible Because Of Conservation Tillage
- Difficult Planting Into Residue With High Surface Manure Rates
A Greater Challenge For Semi-solid, Daily Haul

Alternatives To Full-width Tillage Following 30 T/A
Main Effect Of Manure Rate On The Surface Crop Residue and Emergence

**Manure rate effect on residue after planting, 2003**

**Marshfield emergence, 2002**
MAIN EFFECT OF MANURE RATE ON CORN YIELD, 2002-2003

2002

2003
Greater Flexibility With Liquid Systems
“Residue Friendly” Incorporation
Phosphorus Will Direct Future Nutrient Management

- Soil test P averages excessively high
- Greater risk of P loss from high soil test P sites
- Complex management issues
  - Residue/Tillage
  - Manure
  - Landscape
- Phosphorus Index integrates these factors
Average Soil Test P in Wisconsin

Period

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<td>Average P Test (ppm)</td>
<td>34</td>
<td>36</td>
<td>40</td>
<td>44</td>
<td>48</td>
<td>50</td>
<td>52</td>
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</table>
Soil Test P Changes Slowly

**Example (18 lb P$_2$O$_5$ : 1 lb P)**

- Soil P test = 100 ppm = EH
- Optimum soil test = 20 ppm
- Removal needed for EH to Opt. = 18 lb P$_2$O$_5$/acre x 80 ppm = 1440 lb P$_2$O$_5$
- Corn grain removes 60 lb P$_2$O$_5$/acre/year
- 1440/60 = 24 yrs with no added P for EH change to optimum
Wisconsin Datasets are Used for P Index Development

Simulated rainfall runoff:

- Alfalfa - 20 events
- Corn - 267 events, 4 sites
  Varying:
  - Tillage
  - Manure applications
  - Timing
  - Soil test P
Relationship between Bray $P_1$ (0-1 in) and DRP in runoff.

<table>
<thead>
<tr>
<th>Tillage/manure</th>
<th>Runoff volume (mm)</th>
<th>Sediment load (kg/ha)</th>
<th>Runoff Phosphorus Soluble (--- g/ha ---)</th>
<th>Total</th>
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<tr>
<td>No-till -</td>
<td>16</td>
<td>153</td>
<td>32</td>
<td>107</td>
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<tr>
<td>No-till +</td>
<td>14</td>
<td>60</td>
<td>207</td>
<td>277</td>
</tr>
<tr>
<td>C.Plow -</td>
<td>39</td>
<td>3019</td>
<td>44</td>
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<tr>
<td>C.Plow +</td>
<td>24</td>
<td>1461</td>
<td>68</td>
<td>573</td>
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</table>
Tillage and fall-applied manure effects on sediment and phosphorus in runoff. Arlington, October, 2002.

<table>
<thead>
<tr>
<th>Manure/tillage</th>
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<th>Sediment load (kg/ha)</th>
<th>Runoff Phosphorus (g/ha)</th>
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<tbody>
<tr>
<td>None NT</td>
<td>17</td>
<td>105</td>
<td>9</td>
</tr>
<tr>
<td>None CP</td>
<td>4</td>
<td>279</td>
<td>3</td>
</tr>
<tr>
<td>Solid NT</td>
<td>30</td>
<td>317</td>
<td>1396</td>
</tr>
<tr>
<td>Solid CP</td>
<td>5</td>
<td>245</td>
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<tr>
<td>Liquid NT</td>
<td>39</td>
<td>568</td>
<td>2543</td>
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<tr>
<td>Liquid CP</td>
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<td>326</td>
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<tr>
<td>Liquid Inj.</td>
<td>23</td>
<td>267</td>
<td>89</td>
</tr>
</tbody>
</table>
Spring Manure Management

**Areas to apply**
- Prior to tillage
- No-till corn
- Inject manure

**Areas to avoid**
- Estab. Alfalfa
- On snow/frozen ground
- Wet soils
**Fall Manure Management**

**Areas to apply**
- Post-tillage to fall-plowed fields
- Before/after tillage on fall chiseled fields
- After silage
- Before tillage on old hay fields
- Inject manure

**Areas to avoid**
- Estab. Alfalfa
- No-till corn
- Smooth surfaces with little residue cover
Winter Manure Management

Areas to apply
- Level chisel plowed fields
- Slopes less than 6%
- Little upslope runoff

Areas to avoid
- Estab. Alfalfa
- No-till corn
- Slopes over 6%
Summary

- Forage/livestock producers will have challenges as the “landscape” changes.
- Rules will require improved conservation management.
- More focus on P.
- Management flexibility still remains.
- Make informed decisions.