

# HOW CHANGES IN NUTRIENT MANAGEMENT REGULATIONS WILL AFFECT FORAGE PRODUCTION

Dick Wolkowski and Larry Bundy  
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

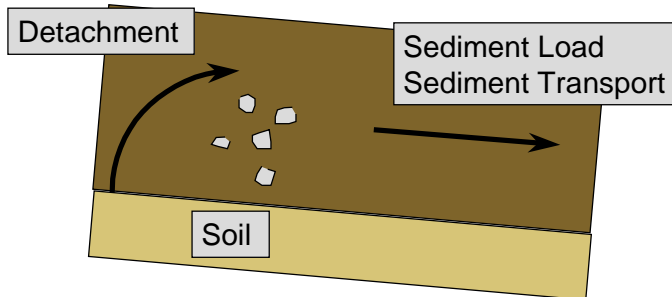
- Loss Of OM, Clay, And Nutrients Reduces Productivity
- Damage To Plants
- Formation Of Rills And Gullies Affects Management
- Sedimentation In Waterways, Diversions, Terraces, Ditches
- Delivery Of Nutrients To Surface Water



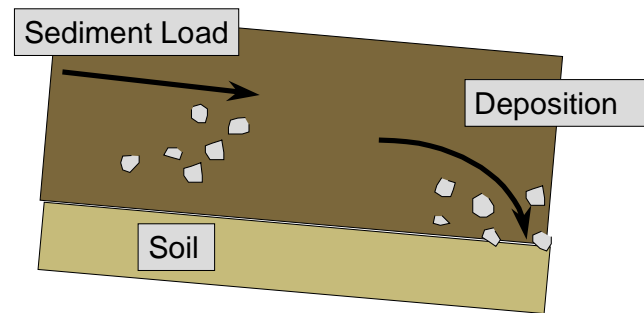
# The Water Erosion Process



## 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

## Criteria For All Sites

- "T" Shall Not Be Exceeded
- Follow UWEX Recommendations
- Manure Shall Not Be Spread In Concentrated Flow Channels
- Establish Perennial Vegetation 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)



## 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

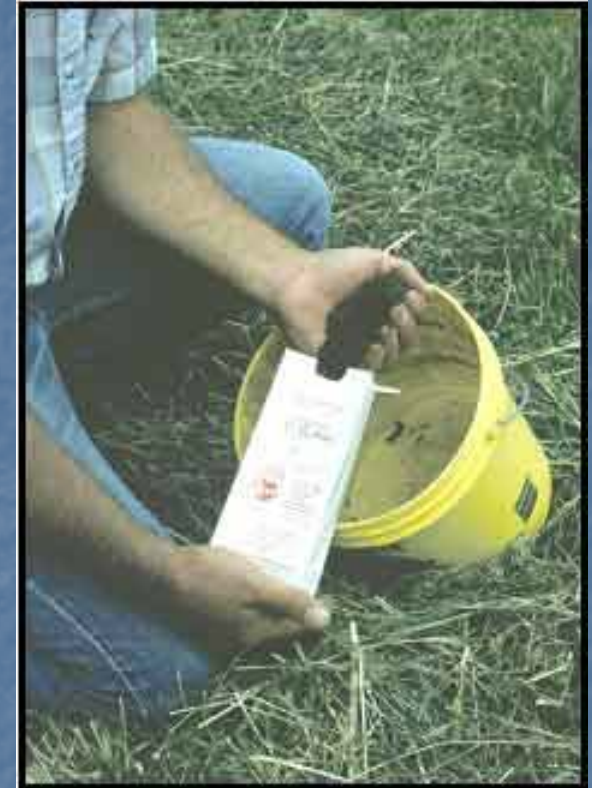


# How Many Samples to Take

Responsive fields  
Sample every 5 acres

Non-responsive fields

SAMPLE NUMBERS	FIELD SIZE (ac)
2	1 - 10
3	11 - 25
4	26 - 40
5	41 - 60
6	61 - 80
7	81 - 100



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)



# 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)

# 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

## 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)**



# 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



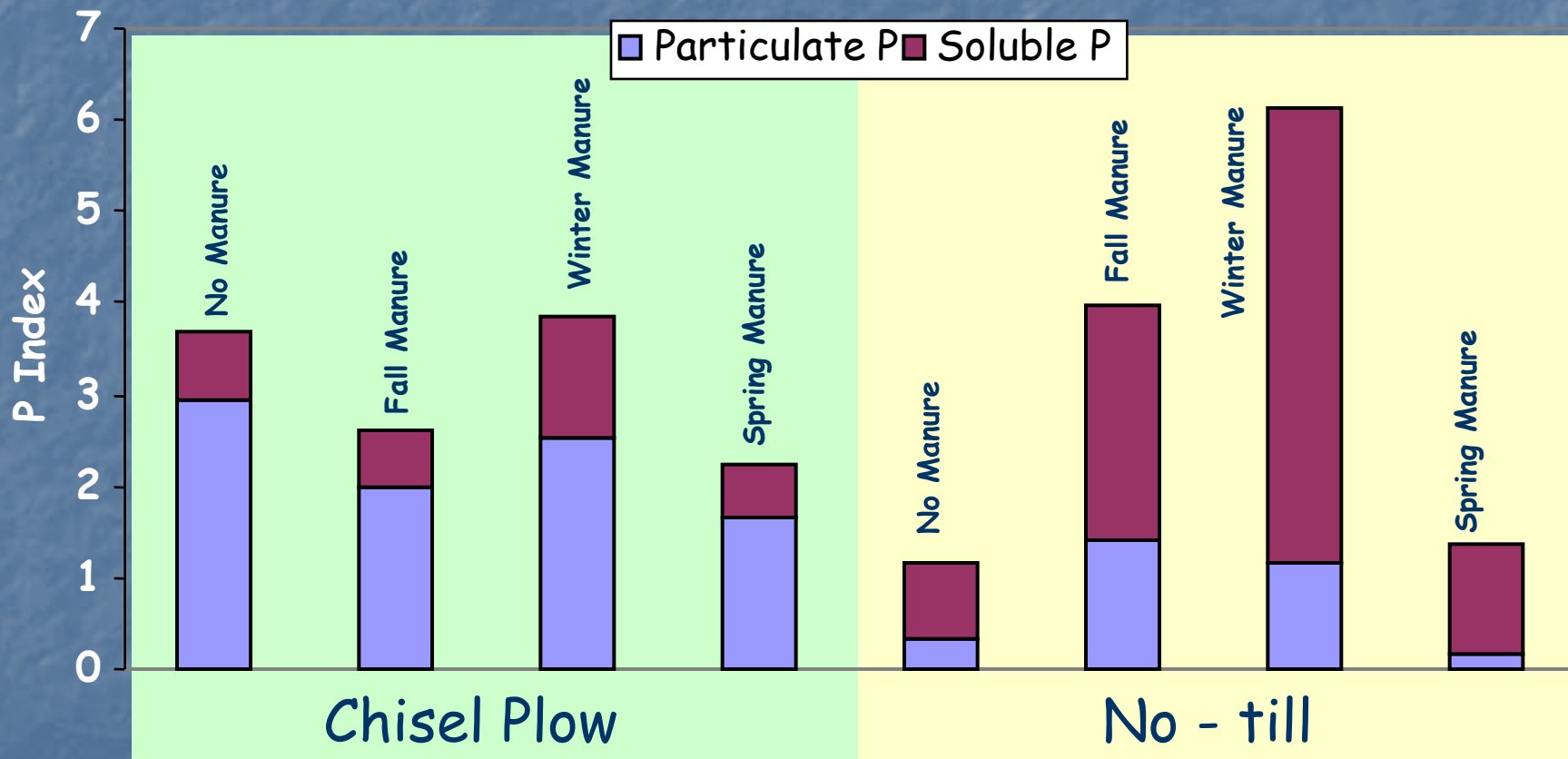
# Putting it all together:



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

## 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"

# 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"



# 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



# Channelized Flow From Field To Stream







**Following Clipping  
of Timothy/Brome  
August, 1999**





**Filter Strip**  
**October, 2001**





**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

NO-TILL



LIGHT DISKING

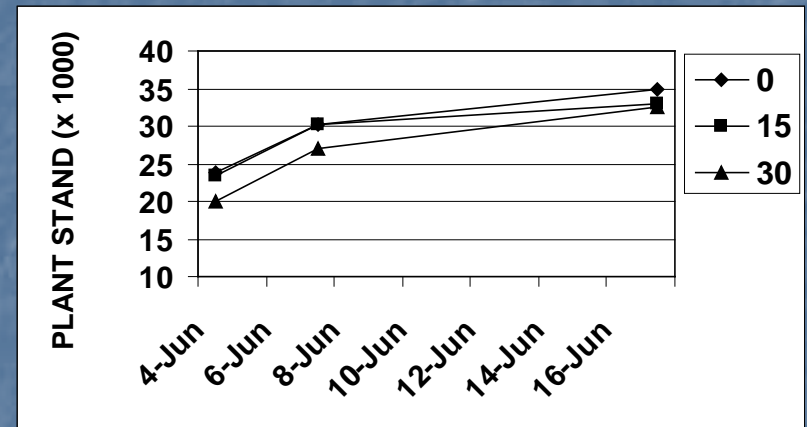
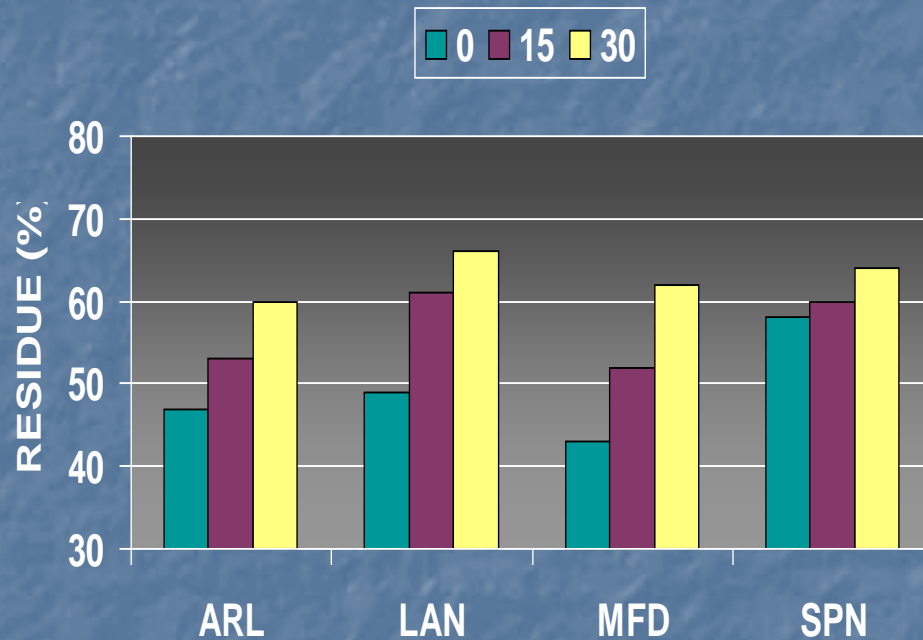


STRIP-TILL



Alternatives To  
Full-width Tillage  
Following 30 T/A

# Main Effect Of Manure Rate On The Surface Crop Residue and Emergence

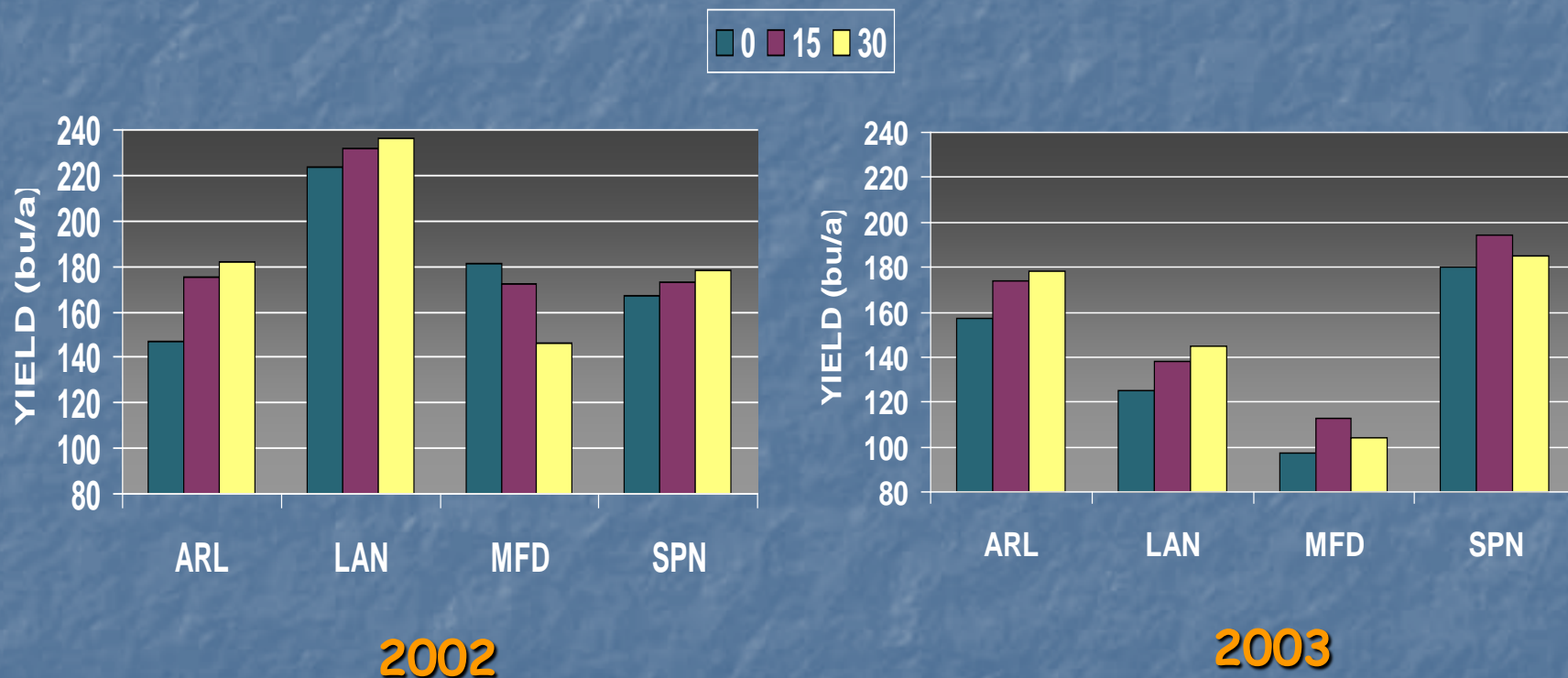


Marshfield emergence, 2002

Manure rate effect on residue  
after planting, 2003



# MAIN EFFECT OF MANURE RATE ON CORN YIELD, 2002-2003



# Greater Flexibility With Liquid Systems





# "Residue Friendly" Incorporation

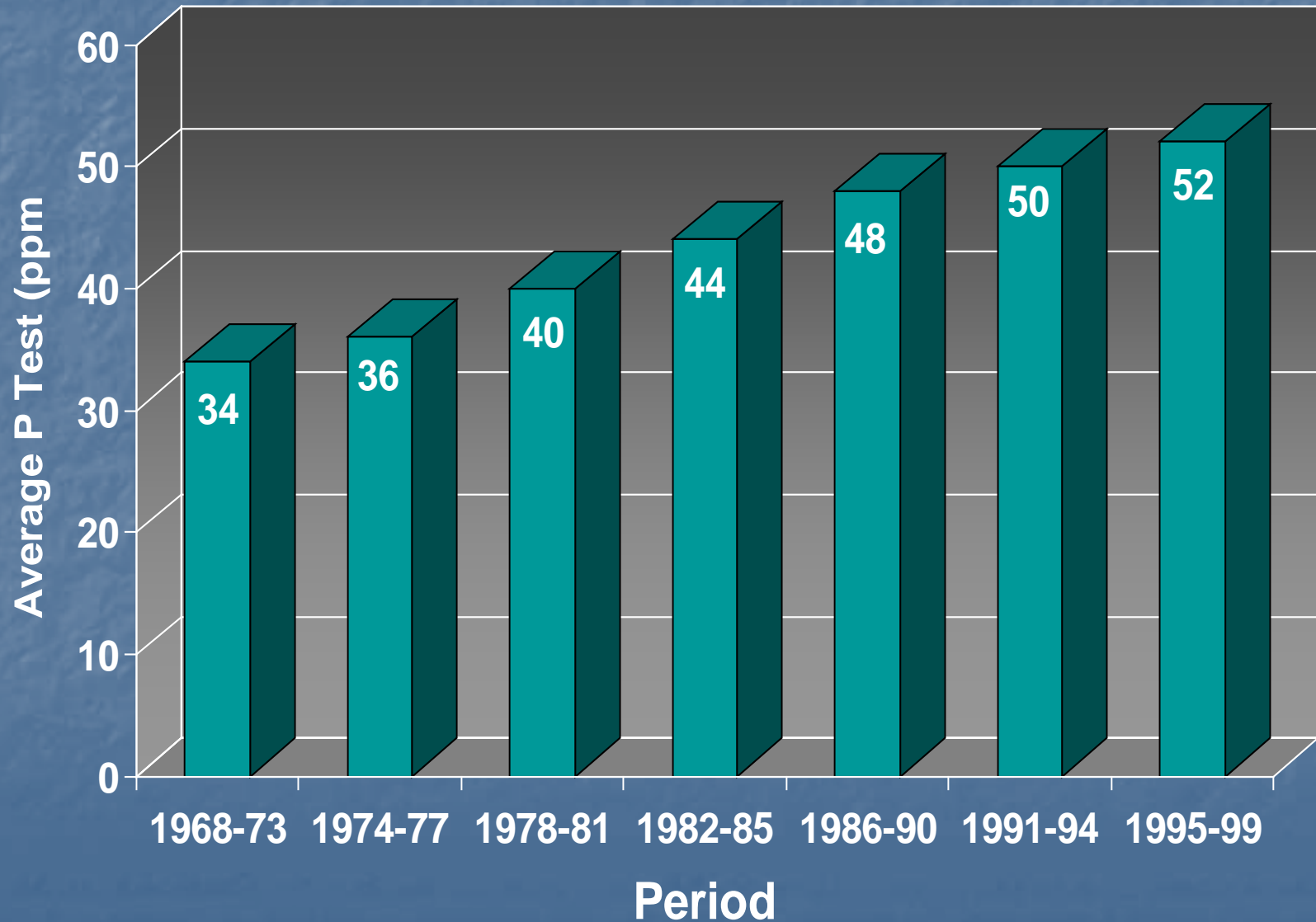


# Phosphorus Will Direct Future Nutrient Management

- 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



# Soil Test P Changes Slowly

## Example (18 lb $P_2O_5$ : 1 lb P)

- Soil P test = 100 ppm = EH
- Optimum soil test = 20 ppm
- Removal needed for EH to Opt. = 18  
lb  $P_2O_5$ /acre  $\times$  80 ppm = 1440 lb  
 $P_2O_5$
- Corn grain removes 60 lb  
 $P_2O_5$ /acre/year
- $1440/60 = 24$  yrs with no added P  
for EH change to optimum



# Wisconsin Datasets are Used for P Index Development

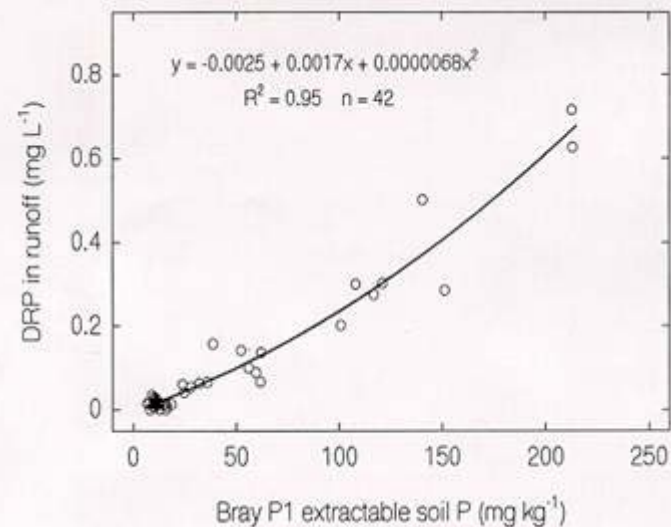
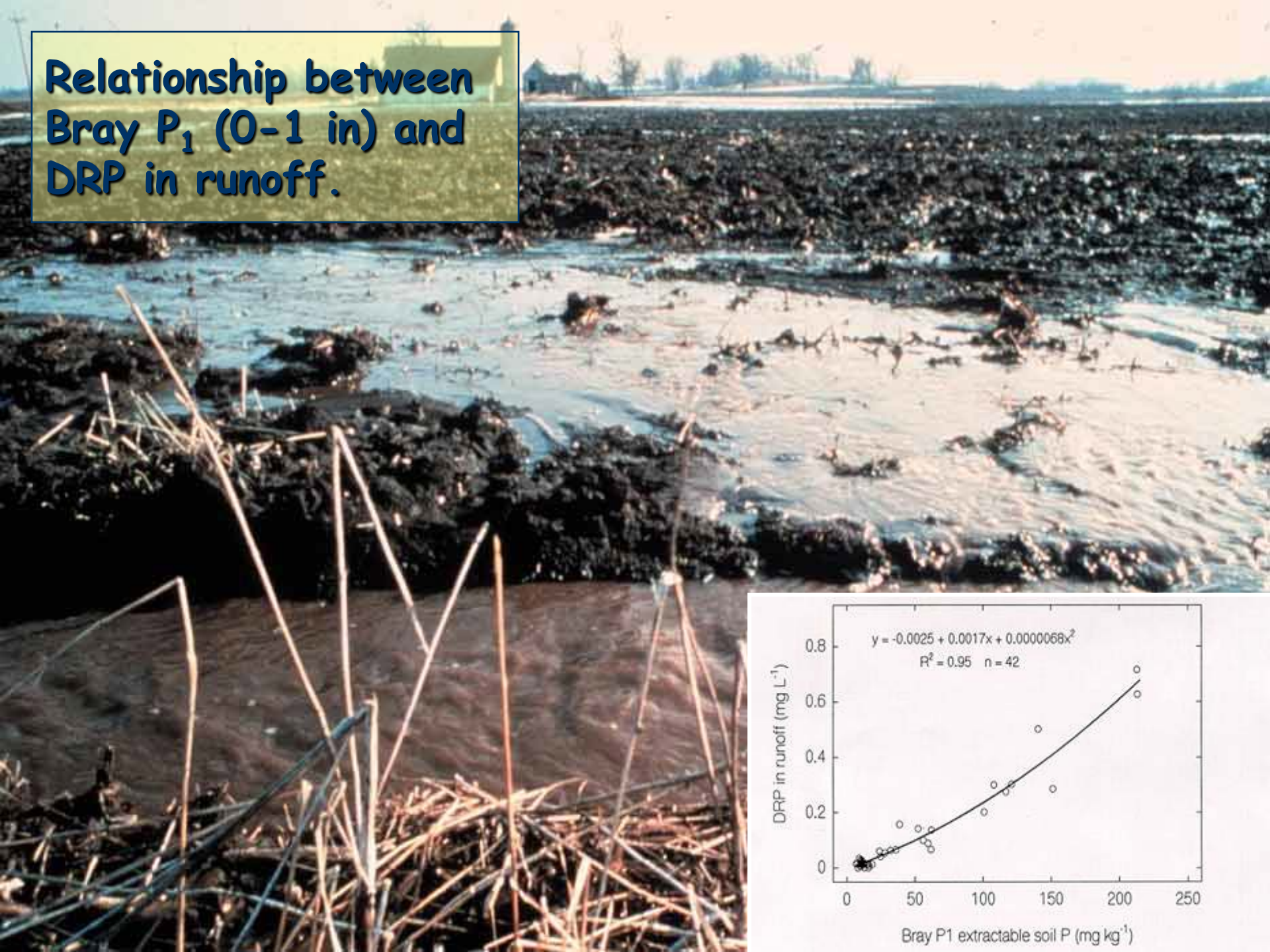
Simulated rainfall runoff:

- ❑ Alfalfa – 20 events
- ❑ Corn – 267 events, 4 sites
  - Varying:
    - ❑ Tillage
    - ❑ Manure applications
    - ❑ Timing
    - ❑ Soil test P





# Relationship between Bray P<sub>1</sub> (0-1 in) and DRP in runoff.





# Tillage and spring-applied manure effects on sediment and phosphorus in runoff. Lancaster, May, 2000.

Tillage/ manure	Runoff volume mm	Sediment load kg/ha	Runoff Phosphorus	
			<u>Soluble</u>	<u>Total</u>
			--- g/ha ---	
No-till -	16	153	32	107
No-till +	14	60	207	277
C.Plough -	39	3019	44	1145
C.Plough +	24	1461	68	573

# Tillage and fall-applied manure effects on sediment and phosphorus in runoff. Arlington, October, 2002.

Manure/ tillage	Runoff volume mm	Sediment load kg/ha	Runoff Phosphorus	
			Soluble ----- g/ha	Total -----
None NT	17	105	9	45
None CP	4	279	3	139
Solid NT	30	317	1396	3056
Solid CP	5	245	15	124
Liquid NT	39	568	2543	6102
Liquid CP	7	326	141	294
Liquid Inj.	23	267	89	289



# 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

