

# **Wisconsin Progress on Nutrient Management Education and Research**

**Presentation to the Wisconsin Fertilizer, Aglime,  
and Pest Management Conference  
January 22, 2004**

**Scott J. Sturgul**

NPM Program

University of Wisconsin-Madison

**Larry G. Bundy**

Dept. of Soil Science

University of Wisconsin-Madison

**Sue M. Porter**

Wis. Dept. of Agric. Trade & Consumer Protection

# Nutrient Management

- Combine on-farm nutrient sources, with commercial fertilizer, to meet crop need.



On-farm nutrient sources  
(manure, legumes, soil reserves)

Commercial fertilizer

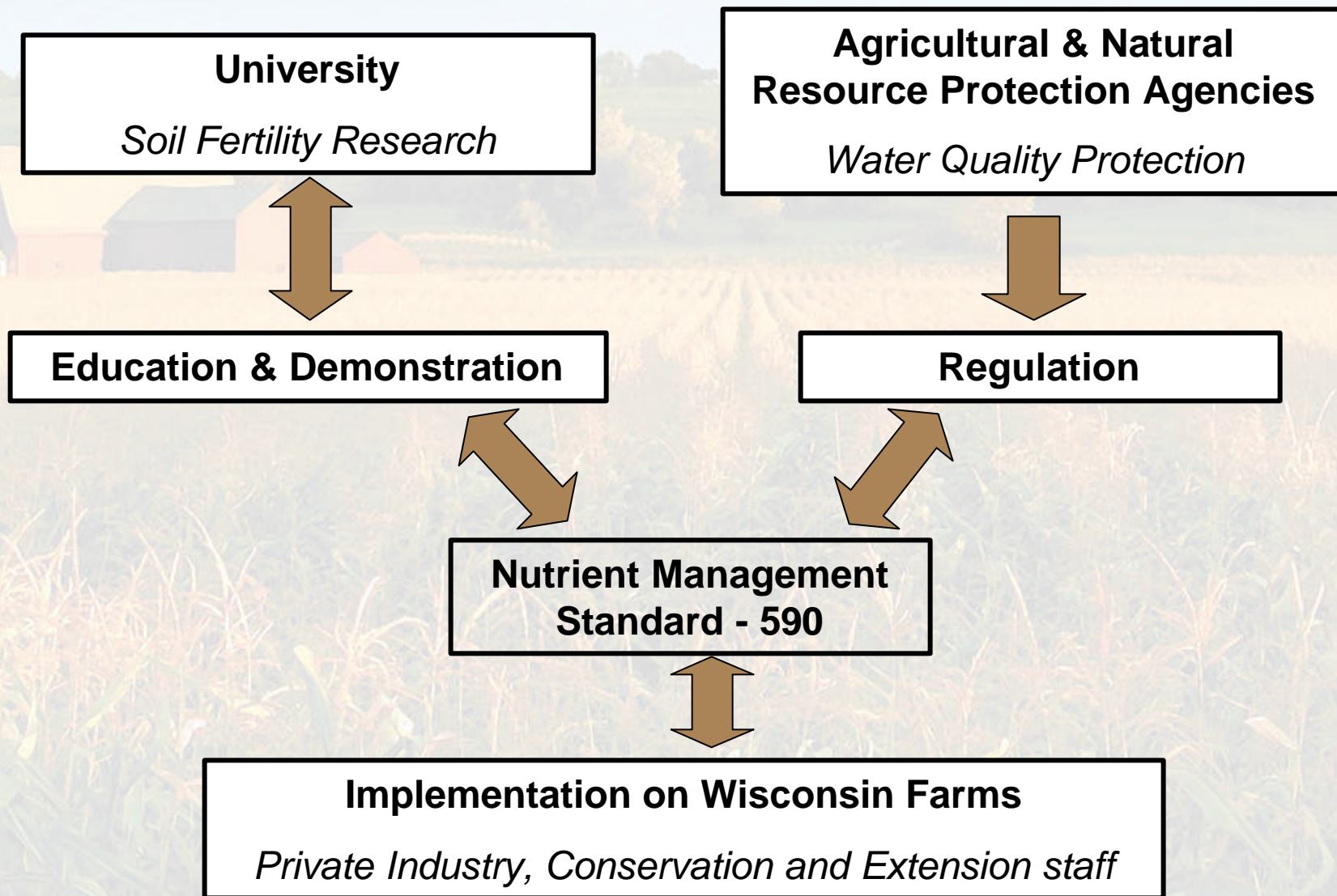
Minimize nutrient losses



# Research-based Recommendations/BMP's

- Corn nitrogen recommendations
- P & K calibration & recommendations
- Legume-nitrogen credits
- Manure credits
- Residual soil nitrate tests
- Starter fertilizer recommendations

# Implementing Nutrient Management Planning in Wisconsin







# Education/Implementation Efforts



# On-farm Demonstrations



- Promote agricultural management practices that protect water quality while maintaining or improving farm profitability.
- Facilitate information exchange between farmers and researchers.





# Publications

## Soil Testing Basics

### WHY YOU SHOULD SOIL TEST

Soil testing is a relatively simple and inexpensive procedure. It can tell you how much fertilizer to apply, and it can tell you how much fertilizer to apply. It can tell you how much fertilizer to apply, and it can tell you how much fertilizer to apply. It can tell you how much fertilizer to apply, and it can tell you how much fertilizer to apply.

### WHAT A SOIL TEST TELLS YOU

Soil testing tells you the amount of nutrients in your soil. It tells you the pH of your soil, and it tells you the amount of nutrients in your soil. It tells you the pH of your soil, and it tells you the amount of nutrients in your soil.

### WHEN YOU SHOULD SOIL TEST

Soil testing should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years.

Soil testing should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years.

## Know How Much You Haul!

Transportation is a costly, unpredictable factor in your business. You need an easy-to-use spreadsheet to help you estimate your hauling costs. This spreadsheet can help you estimate your hauling costs. It can help you estimate your hauling costs, and it can help you estimate your hauling costs.

### STEP 1. DETERMINING LOAD WEIGHT

1. Weigh a typical load. Use a scale to weigh a typical load. Use a scale to weigh a typical load. Use a scale to weigh a typical load.

### STEP 2. DETERMINING SPREADING RATE

2. Determine the spreading rate. Determine the spreading rate. Determine the spreading rate. Determine the spreading rate.

### STEP 3. DETERMINING MANURE NITROGEN CREDIT

3. Determine the manure nitrogen credit. Determine the manure nitrogen credit. Determine the manure nitrogen credit. Determine the manure nitrogen credit.

## HOW YOU SHOULD SOIL TEST

Soil testing should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years.

Soil testing should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years.

### WHEN YOU SHOULD SOIL TEST

Soil testing should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years.

Soil testing should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years. It should be done every 1-2 years.

### Soil Test Report

Soil Test Report

### Manure info.

Manure info.

### Corn

Corn

### Alfalfa

Alfalfa

### Soybean

Soybean

### Legume N credits

Legume N credits

### Field Crops

Field Crops

### Green Manure

Green Manure

## What Is A Farm Nutrient Management Plan?

A farm nutrient management plan is a document that describes the methods used to manage the nutrients in your soil. It describes the methods used to manage the nutrients in your soil. It describes the methods used to manage the nutrients in your soil.



There are basic components to all farm nutrient management plans. These include the following:

**Soil Test Reports**  
Complete and accurate soil test results are the starting point of any farm nutrient management plan. All crop and field soils must be tested or have been tested within the last three years. From the soil test results, the base fertilizer recommendations for each field are given.

**Assessment Of On-farm Nutrient Resources**  
The amount of crop nutrients supplied to your fields from on-farm nutrient resources, such as manure, legumes, and organic wastes, must be determined and deducted from your base fertilizer recommendations.

Manure applications to fields apply crops with nitrogen, phosphorus, and potassium as well as sulfur and organic matter. Legume crops such as alfalfa, clover, soybeans, etc. supply nitrogen to the crops that follow them.



## A Step-by-Step Guide to Nutrient Management

### Using Legumes as a Nitrogen Source

Using Legumes as a Nitrogen Source

### Guidelines for Applying Manure to Cropland and Pasture in Wisconsin

Guidelines for Applying Manure to Cropland and Pasture in Wisconsin

## Using Legumes as a Nitrogen Source

### Guidelines for Applying Manure to Cropland and Pasture in Wisconsin

Guidelines for Applying Manure to Cropland and Pasture in Wisconsin

## Guidelines for Applying Manure to Cropland and Pasture in Wisconsin

### Wisconsin's Wiscorsin's Preplant Soil Nitrate Test

Wisconsin's Wiscorsin's Preplant Soil Nitrate Test



# Certified Crop Adviser (CCA) Training

- Annual 2-day pre-test training
- Educational programs to provide CEU's
  - Area fertilizer/soil & water management meetings
  - Wisconsin Fertilizer Conference
  - Research Station Field Days
  - Crop Diagnostic Clinics
- Currently 700+ CCA's in Wisconsin
  - 463 in 1996





# Regional Nutrient Management User Groups

- Intent: Resolve local nutrient management planning issues.
- Location: Six groups regionally distributed across Wisconsin.
- Composition: Local (county-based) conservation and Extension, private sector businesses, state and federal agencies.



# Nutrient Management Farmer Education Program - Curriculum

## Nutrient Management Farmer Education Program

### Curriculum



University of Wisconsin-Extension  
UW-Madison College of Agricultural & Life Sciences

November - 2001

- Based on UW soil fertility recommendations and current nut. mgmt. regulations.
- Delivered locally by UWEX, LCD, NRCS, private industry.
- Workshops, on-farm demonstration, etc. with end product being **functional** nutrient management plans.
- Accomplishments:
  - 1,000+ producers
  - ~ 300,000 acres
  - 28 Wisconsin Counties



# Training for Nutrient Management Planners (TNMP) Workshops

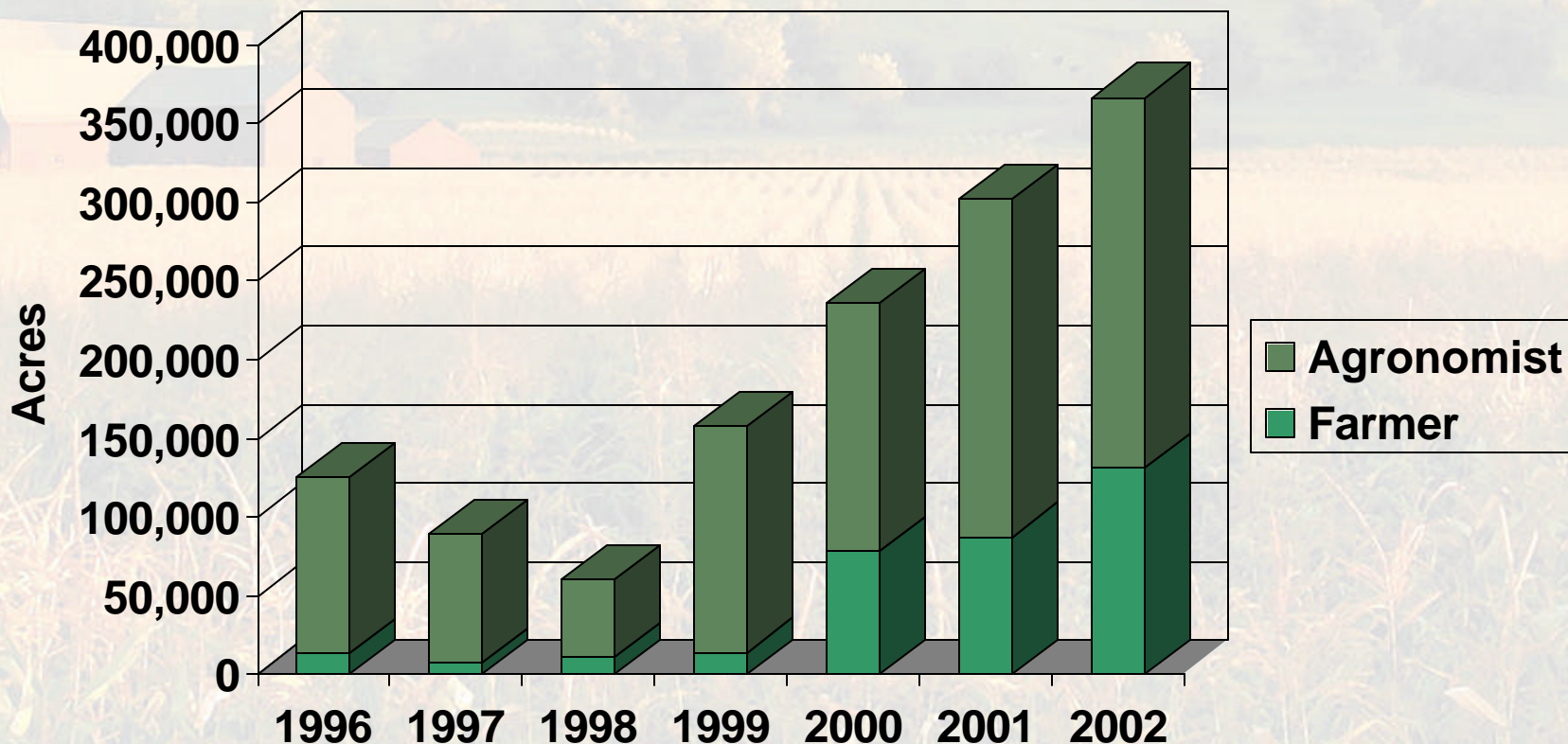
- Principles of NM, conservation planning, manure management, NM regulation requirements, mechanics of assembling a plan, plan writing exercise.
- Audience – Certified Crop Advisors (CCAs) and county-based soil conservation staff.
  - Over 400 participants to date
- Presented by: UWEX, NPM, DATCP, NRCS, DNR
- Financial support from: WI CCA Program and NRCS
- Workshops Completed: 2000 – 3, 2001 – 1, 2003 – 2

# Quality Assurance Team

- Purpose: Annual review of the quality and content of nutrient management plans.
- Composition of Team: Agencies, university, tech college, ag industry, agronomists, soil testing labs, custom manure haulers.
- Review process: 15 plans randomly selected each year. Constructive review of individual plans.
- Feedback mechanism: Letter to planner identifying strengths / weaknesses of plan and suggestions for improving future plans.



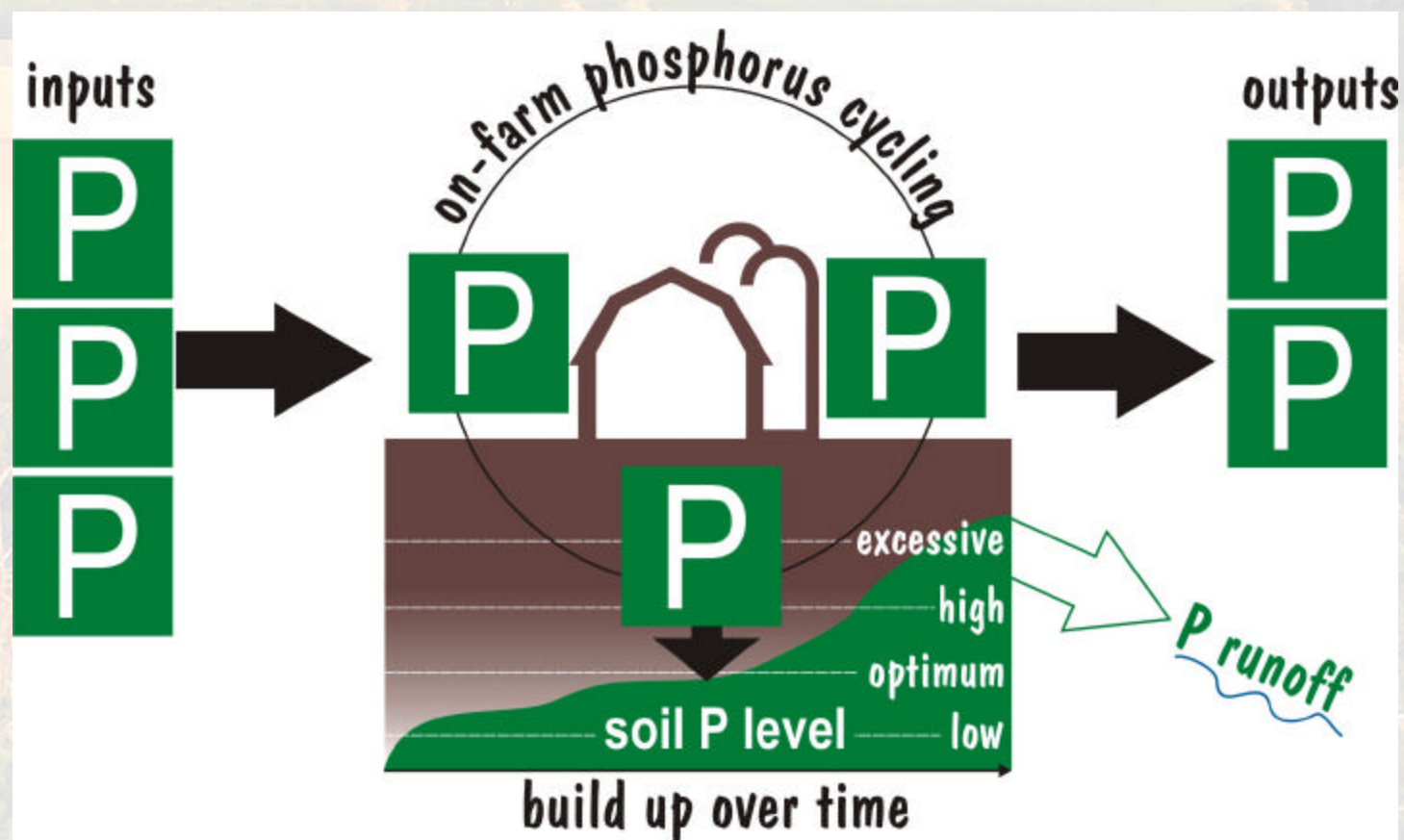
# Nutrient Management Plan Acres Reported: 1996-2002



**4,018 plans reported on 1.3 million acres since 1995.**



# On-farm Phosphorus Balance





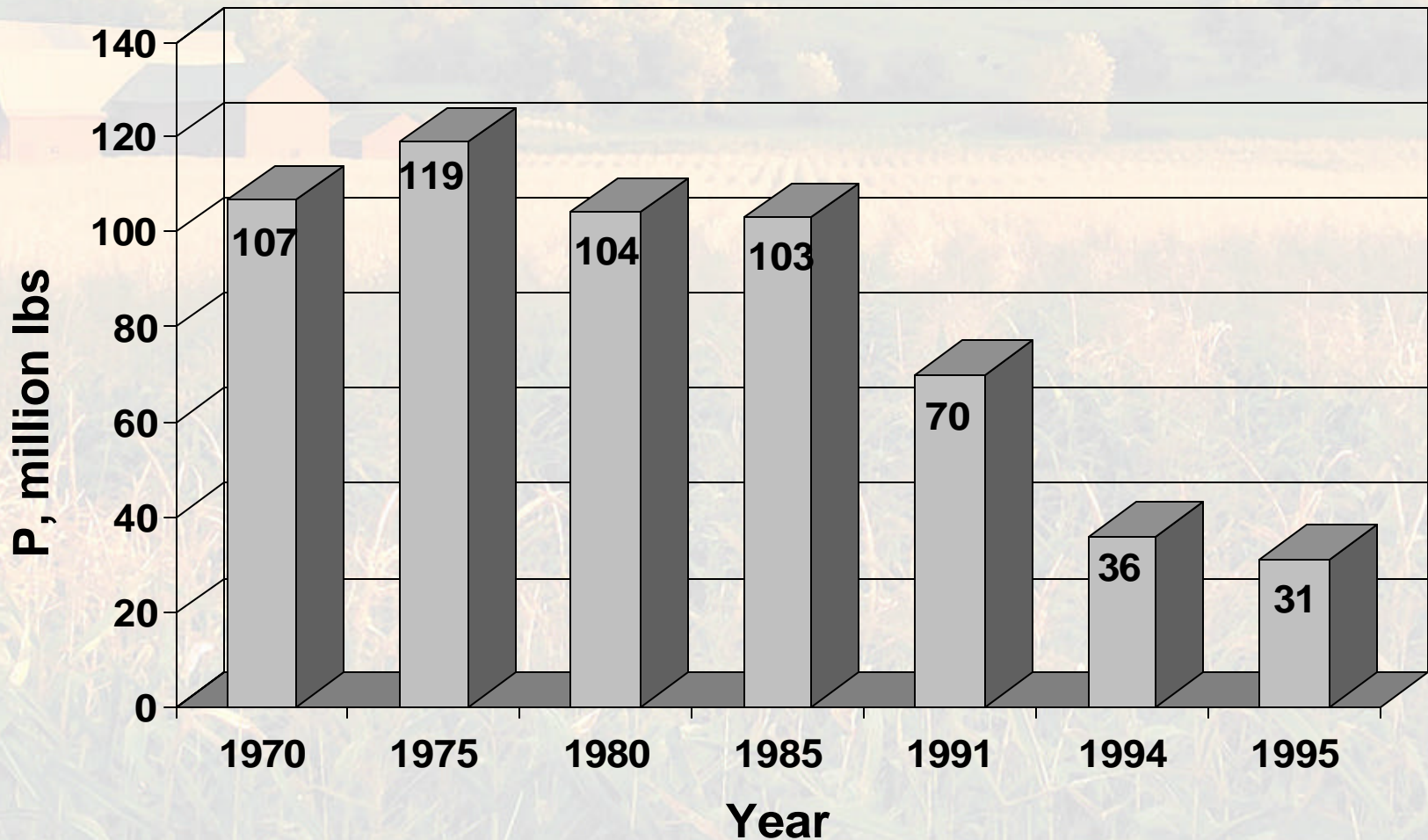
# Implementing Phosphorus-based Nutrient Management

- Research-Awareness-Education Model
  - Research



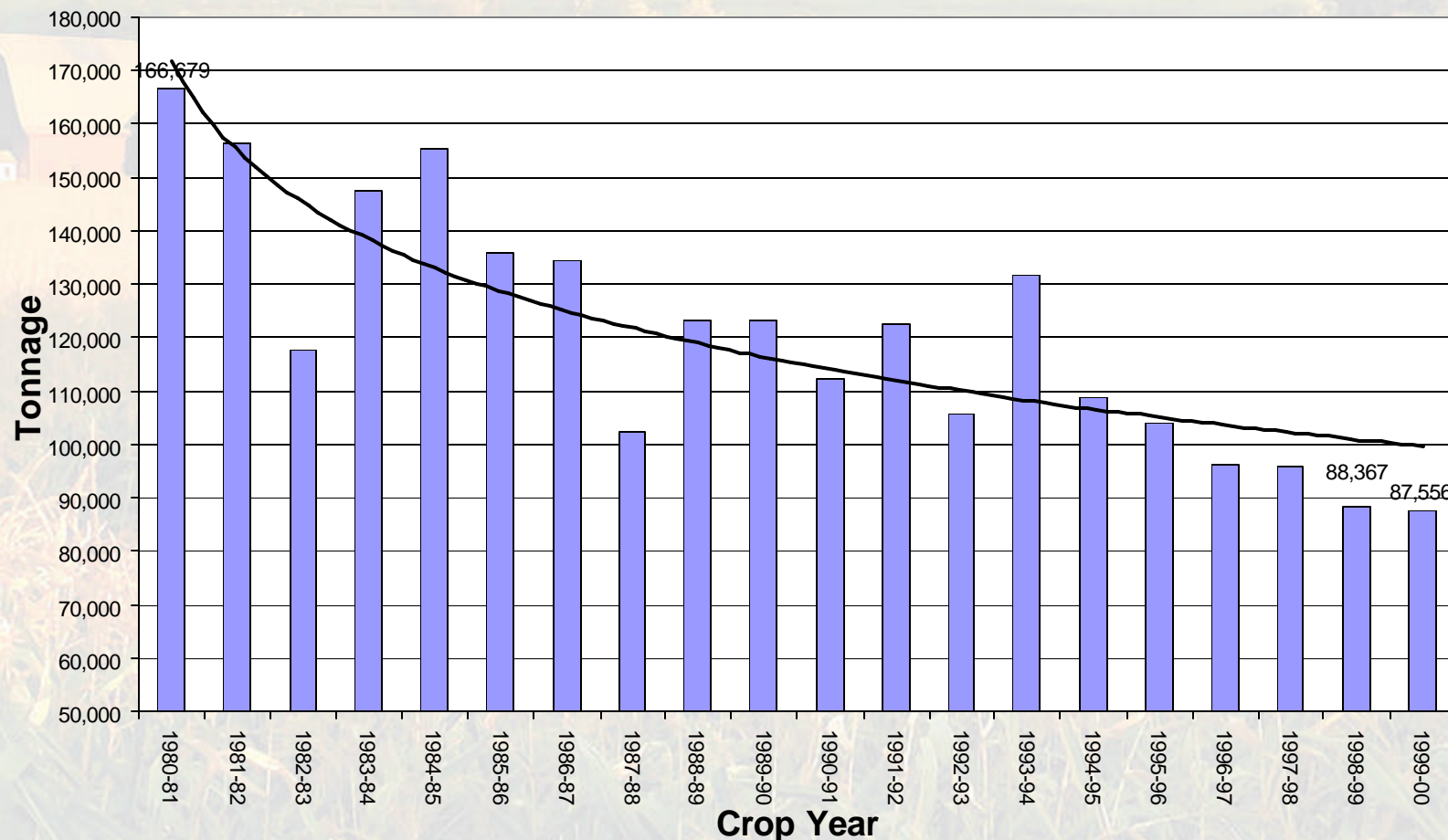
# Cropland P Budget Findings

Change in phosphorus soil storage from 1970-1995.

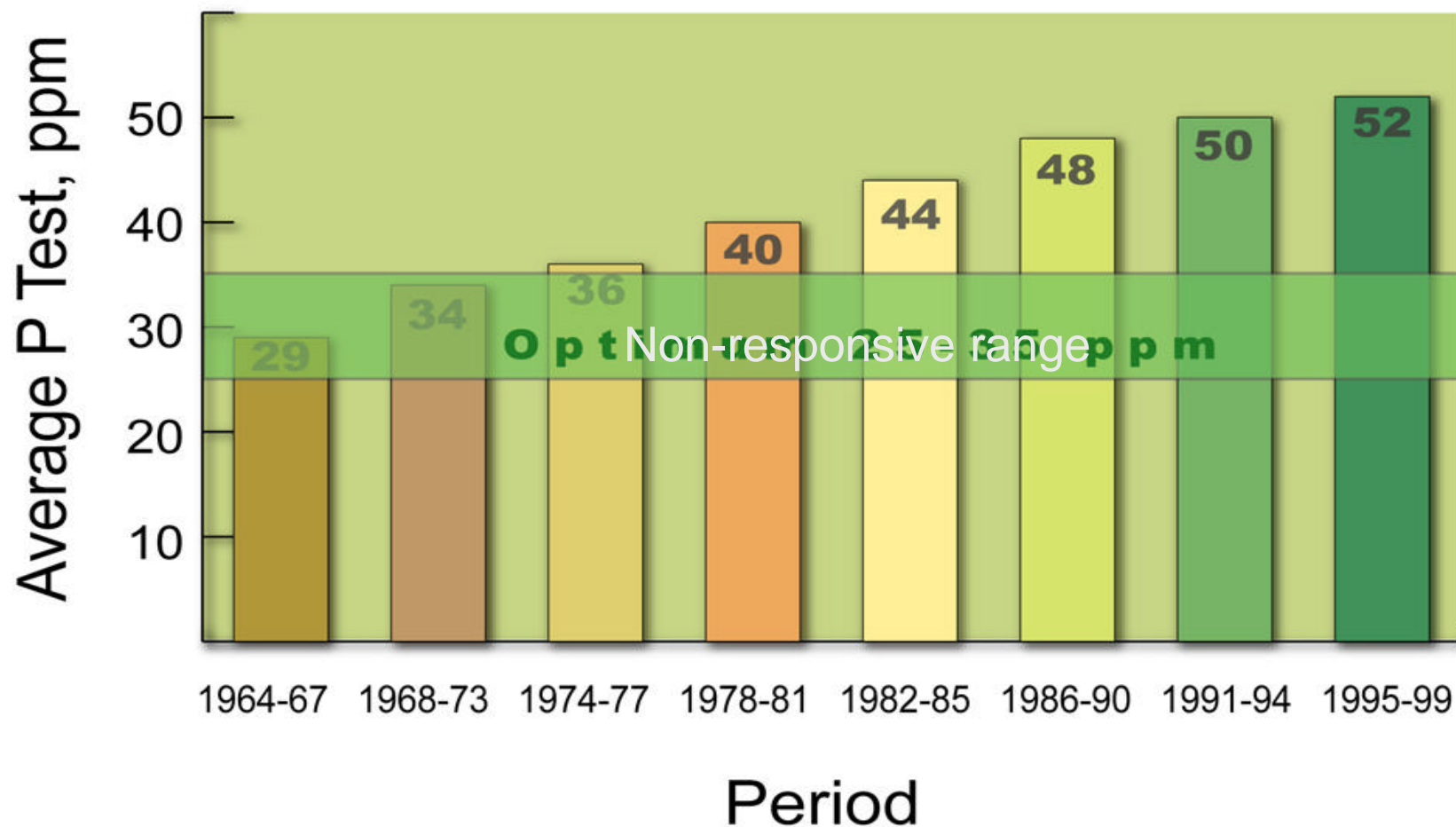




# Commercial Phosphate Consumption in Wisconsin



## Average soil P levels of Wisconsin cropland fields over time.



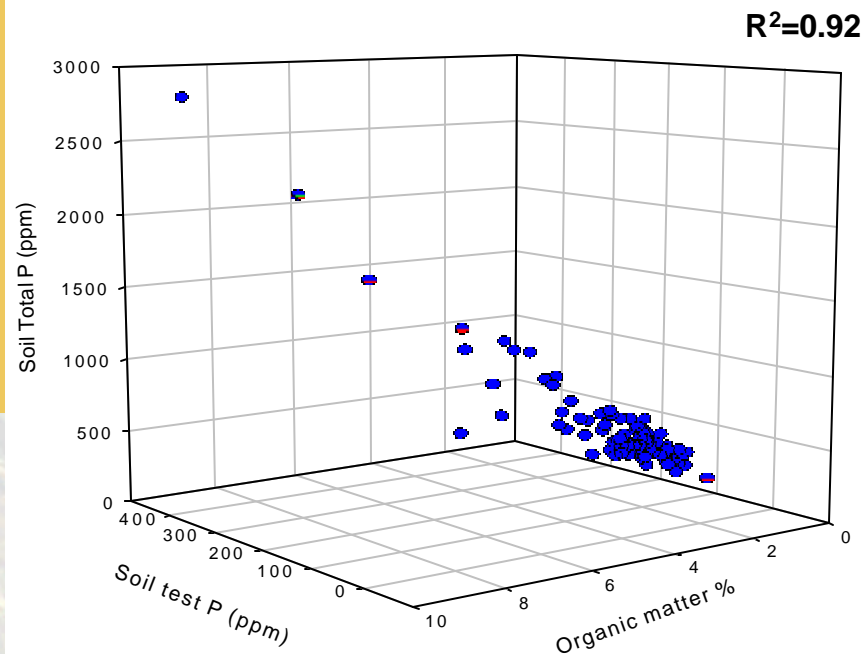
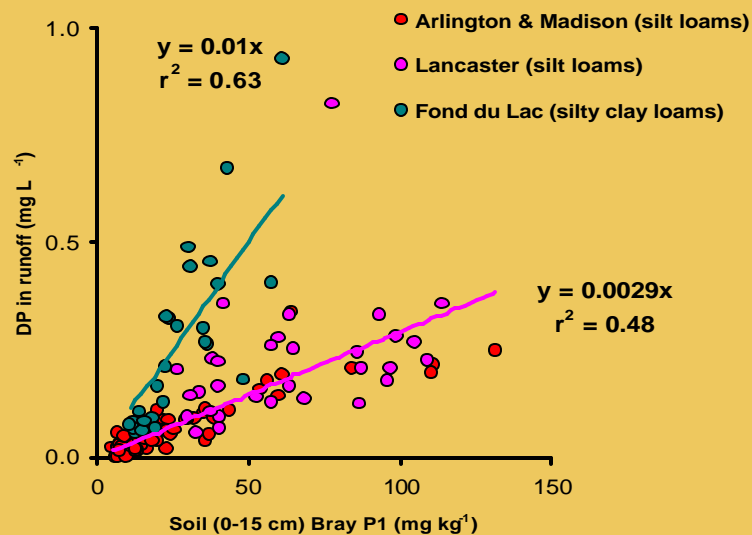


# Tillage, Manure, & Timing Interactions on P Loss





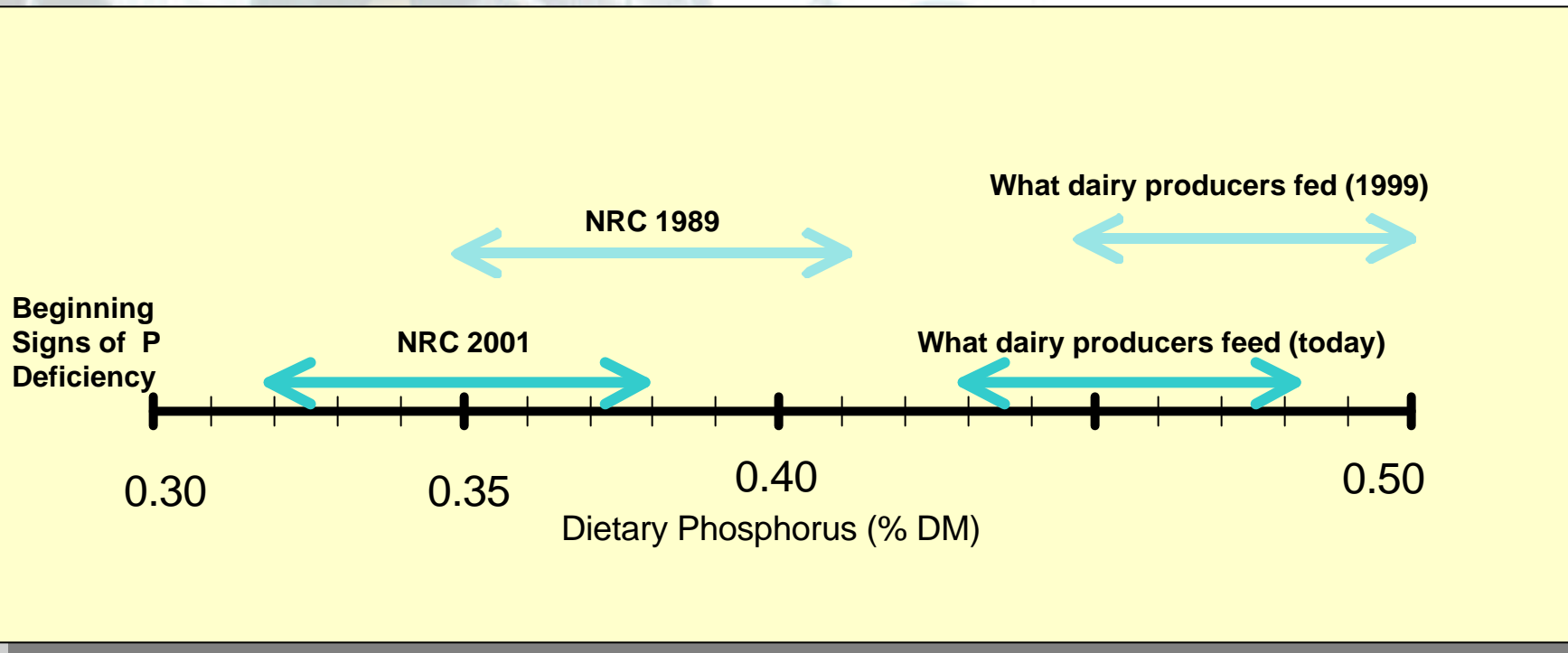
# Relationships of Soil Test P to the P Content of Runoff



$$\text{Soil Total P} = -77.8 + 170 (\text{OM}\%) + 2.5 (\text{Bray P})$$



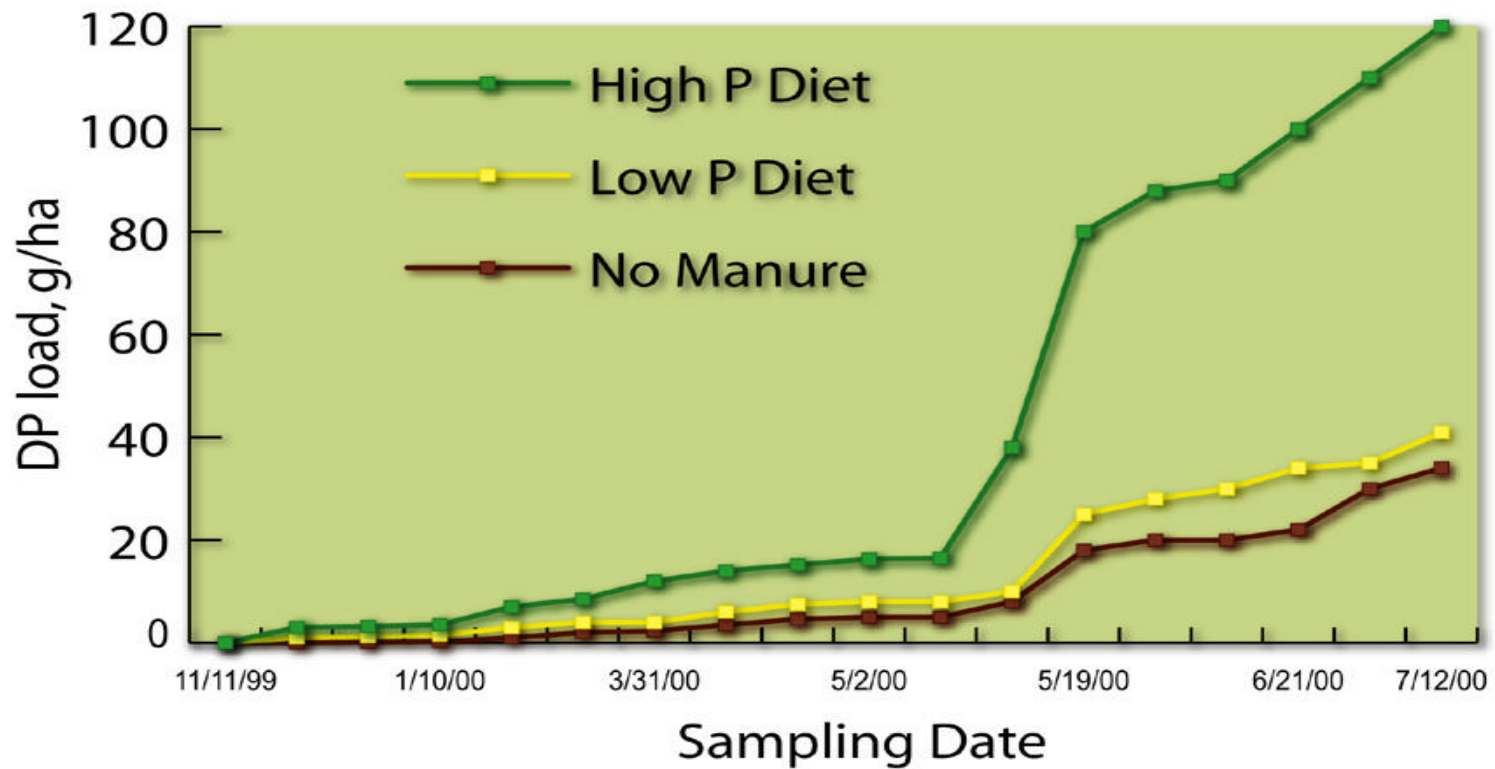
# How Much P is Being Fed?



More than half of Wisconsin dairy farmers over-feed phosphorus relative to National Research Council recommendations.\*

\* Source: Powell et al, 2002 survey of 93 farms.

# Effect of Dietary-P Intake on P Losses in Runoff over Time

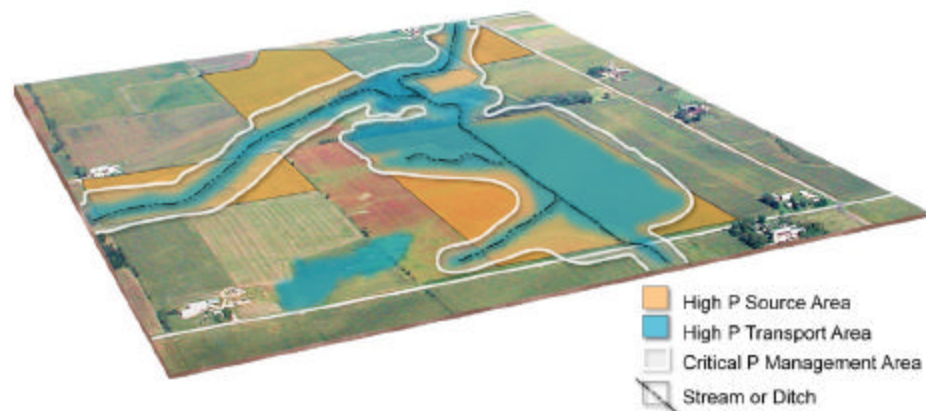
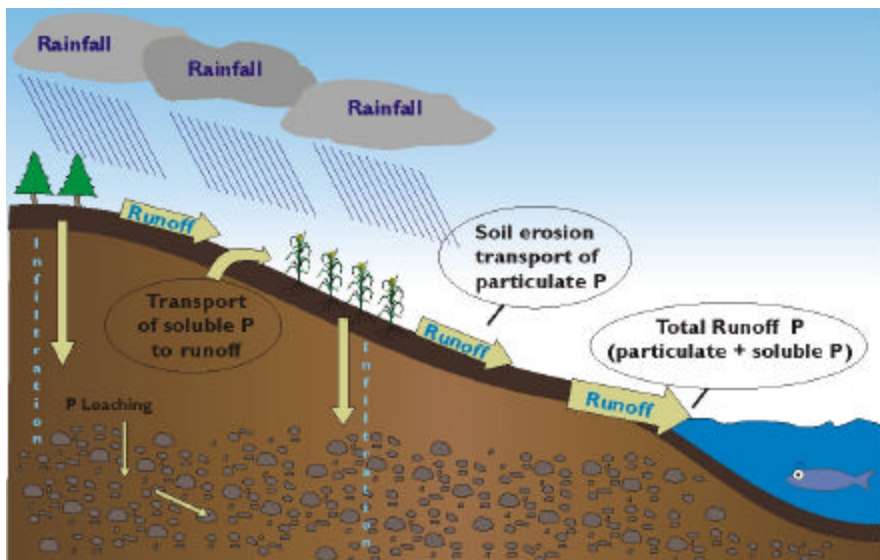




# The Wisconsin P Index

L. G. Bundy, L. Ward Good, and W.M. Jarrell

Dept. of Soil Science - University of Wisconsin-Madison



$$PI = PP + SP$$

<http://wpindex.soils.wisc.edu>

# Implementing Phosphorus-based Nutrient Management

- Research-Awareness-Education Model
  - Research
  - Awareness



# Revised 590 Nutrient Management Standard-2002

- USDA-NRCS Technical Guide Standard.
- Developed by multi-agency and multi-disciplinary committee.
- Includes options for P-based nutrient management plans.
  - Soil test P
  - Wisconsin P index

# Phosphorus Research Roundtables



- Focused, multi-disciplinary discussions of P and P management.
- PowerPoint presentations, abstracts, discussion minutes, summary documents (conclusions, issues to resolve, research/information needs).
  - 13 topics
- [http://www.soils.wisc.edu/extension/p\\_roundtables/title.htm](http://www.soils.wisc.edu/extension/p_roundtables/title.htm) OR link from UW Soil Science Extension website.



# Implementing Phosphorus-based Nutrient Management

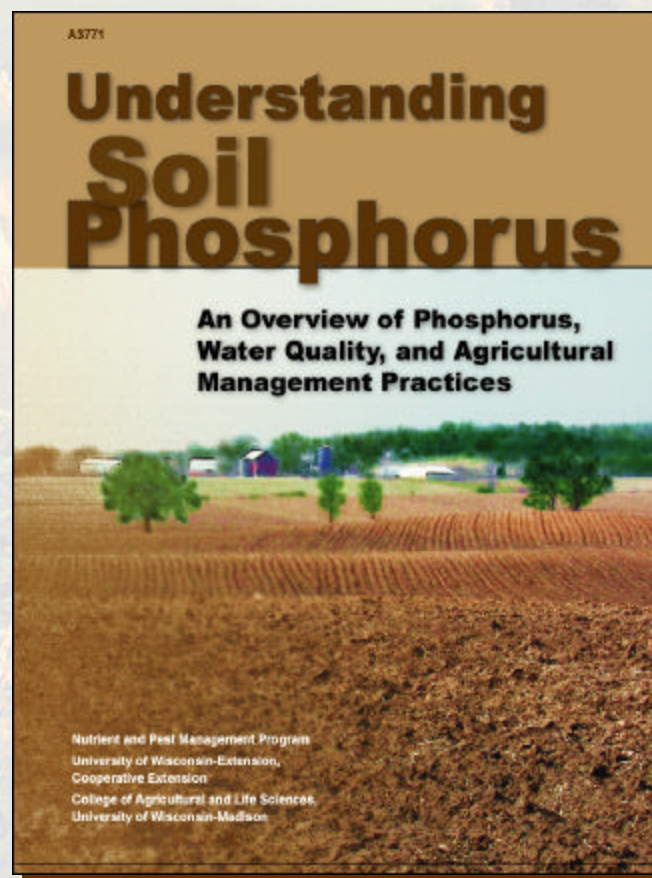
## ➤ Research-Awareness-Education Model

- Research
- Awareness
- Education



# *Understanding Soil Phosphorus*

- Summary Publication:
  - Water Quality
  - P Cycle
  - P Sources & Land Use
  - P Transport
  - P Terminology
  - Ag Management Practices
- Printed in April, 2002
  - Requested and funded by state natural resources and agricultural agencies





# Understanding Soil P: Spin-offs



**Dietary Phosphorus Considerations in Dairy Management**

**Why be concerned about Phosphorus?** Phosphorus is essential to productivity and performance. While

**Background**  
Phosphorus (P) is an essential nutrient for dairy cows. It is involved in many metabolic processes, including energy metabolism, bone formation, and reproduction. Phosphorus is also a key component of cell membranes and DNA. Deficiencies can lead to reduced milk production, poor reproductive performance, and increased susceptibility to disease.

It is a good idea to have a soil test done every 2-3 years to determine if your soil is deficient in P. If it is, you may need to add P to your fertilizer program. However, it is important to note that adding P to the soil does not necessarily mean that the P is available to the plants. In fact, adding P to the soil can sometimes lead to increased P losses through runoff or leaching. Therefore, it is important to consider the overall P balance of your farm when deciding whether or not to add P to your fertilizer program.



**Management Options for Farms with High Soil Test Phosphorus Levels**

Phosphorus levels may not be possible on some farms because the number of animals present is too large for the land base. Management decisions, however, can reduce P loss. Those that are already high in P have less flexible management options than those with low and medium P levels. But carefully thought-out decisions can provide options for the producer that do not require either buying more land for applying manure or reducing the number of livestock.

This publication suggests options for farmers and nutrient management planners who have soils with high and very high P levels and, therefore, present greater environmental risks. Although the ultimate solution is to achieve long-term balance, we have attempted to identify best management alternatives for farms still working toward P balance.

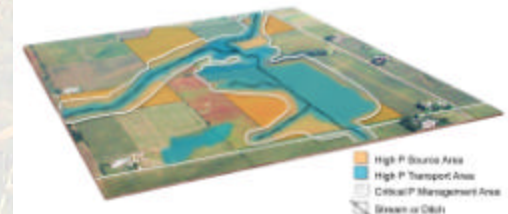
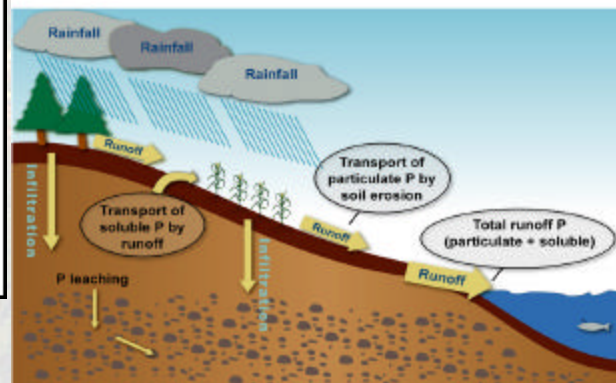
**Figure 1. Critical phosphorus balance.**



## When and Where to Apply Manure

Seasonal guidelines for minimizing phosphorus losses from manured fields

- Dietary P Considerations for Dairy Management
- P Management on High Testing Soils
- When & Where to Apply Manure
- The Wisconsin P Index
- Others to follow . . .





# Balancing Dietary Phosphorus series

## Phosphorus Balancing: The in's and out's

Recent surveys and research on Wisconsin dairy farms indicate that:

1. Phosphorus (P) inputs are often greater than outputs.
2. When inputs are greater than outputs, P will build up in the soil over time.
3. The potential for P runoff increases when soil P is built up to excessive levels.



Phosphorus in runoff causes excessive algae growth in surface waters, which can reduce water quality of streams and lakes.

## Phosphorus Balancing: Optimizing Dietary P Levels



Recent surveys indicate that more than one-half of Wisconsin dairy cows are over fed dietary phosphorus (P)!

## Phosphorus Balancing: Dietary P and Spreadable Acres

### DIETARY PHOSPHORUS (P) FACTS:

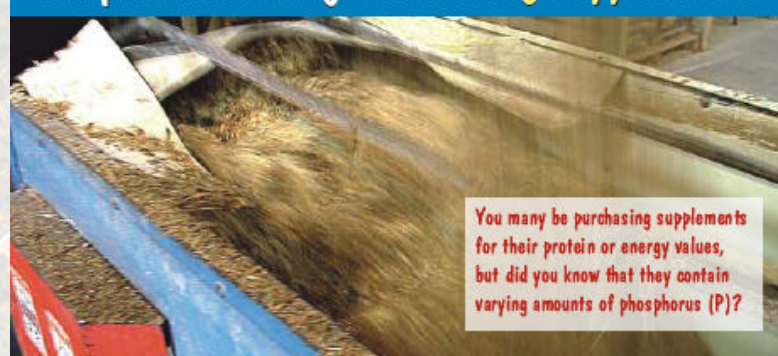
- The maximum dietary P level that is needed for high milk production is 0.38% according to the National Research Council.
- Recent surveys indicate that more than one-half of Wisconsin dairy cows are fed over 0.38% dietary P!
- High dietary P = high manure P.

### SPREADABLE ACRES FACTS:

- Your land may be subject to new and proposed regulations that target P applications to cropland.
- In general, you will need more spreadable acres if you have a phosphorus-based nutrient management plan.
- High manure P = more acres needed to spread manure (according to new/proposed regulations).

Flip the card to see the relationship between dietary P and spreadable acres ➡

## Phosphorus Balancing: Purchasing Supplements



You may be purchasing supplements for their protein or energy values, but did you know that they contain varying amounts of phosphorus (P)?





# Dairy Dietary Curriculum

## ➤ Content:

- Importance
- Nutrient inputs, outputs, and balance
- Phosphorus issues
- Nitrogen issues
- Potassium issues
- Case study

## ➤ Released March, 2003





