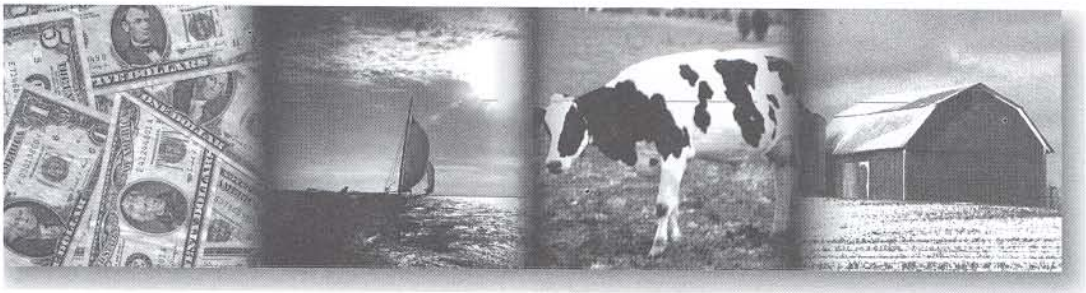

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# NUTRIENT MANAGER

Newsletter of the Maryland Cooperative Extension Agricultural Nutrient Management Program

# Focus On Phosphorus Site Index

*When Tim Brent found that the Fertility Index Value (FIV) for phosphorus on the soil test for his east field was 208, he contacted Jeff, his regular nutrient management consultant, for advice. Jeff said that when he came to update Brent's nutrient management plan next week, he'd run the Phosphorus Site Index for that field.*

*He explained that a field with a Phosphorus Fertility Index Value of over 150 is in the "environmentally high" range for phosphorus. If a producer plans to apply phosphorus in manure or fertilizer, regulations now require an evaluation by the year 2004 of the potential for phosphorus to move off this field—the Phosphorus Site Index (PSI). Brent set aside his concern over the high phosphorus soil test report until Jeff could run the PSI next Tuesday.*

## Why Does Phosphorus Cause Environmental Problems?

Phosphorus is essential for healthy growth of plants; therefore agricultural producers apply it to soils in purchased fertilizer and organic forms such as manure or biosolids. Previously, it was believed that once applied, phosphorus was fixed by soils, necessitating larger applications of phosphorus than plants required. This practice, and the heavy applications of manure due to livestock concentrations, led to an accumulation of phosphorus in many Maryland agricultural fields.

But phosphorus can be lost from soils. Because phosphorus bonds to soil particles, erosion of soil also removes phosphorus from fields. It can also dissolve into runoff or may leach into groundwater. Eventually the excess phosphorus makes its way into bodies of water, where it can cause environmental degradation.

The characteristics of the soil and the site determine the possible movement of phosphorus. Characteristics that might increase possible movement include

- soils that are highly erodible,
- soils that are sandy in texture, and
- fields that are steeply sloped, or in close proximity to a water body, or lacking a vegetated buffer.

Management practices that might affect phosphorus movement include

- applying phosphorus during times outside of the growing season, and
- applying phosphorus to the land surface.

## How Is the PSI Determined?

Research has shown that phosphorus causes an environmental problem only when there is *both* a large source of

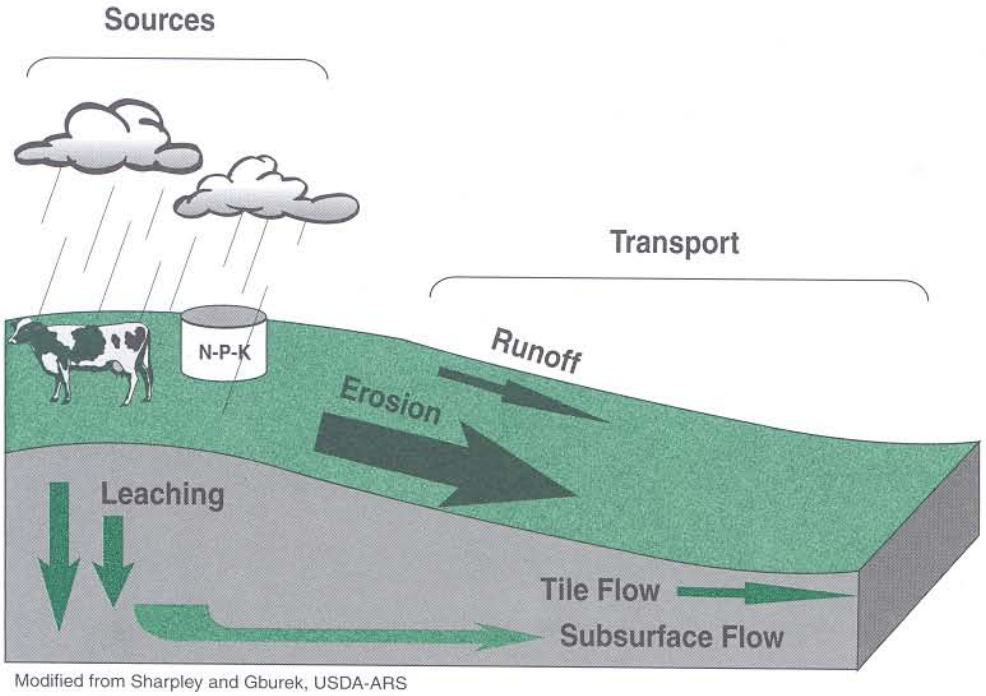



Figure 1. Phosphorus can be released from soil and plant material to surface runoff and subsurface flow or lost by erosion. Source: USDA, Agricultural Research Service, ARS-149, July 1999.

phosphorus (from excessively fertile soil or manure or fertilizer application) *and* a pathway for transport of the phosphorus through such processes as leaching, runoff, and/or erosion. An area with these conditions is called a critical source area. See Figure 1. The PSI uses readily available information to identify critical source areas.

The PSI thoroughly evaluates the soil, the site's hydrologic characteristics, and management of an agricultural field to determine if there is a risk of phosphorus leaving the field. Only fields with soil tests over 150 FIV must have the PSI evaluation determined for them. See Figure 2.

The PSI is broken down into Part A (Site Characteristics) and Part B (Phosphorus Source and Management Characteristics).

### Site Characteristics (Part A)

Part A evaluates six factors of phosphorus loss potential due to site characteristics:

1. **Soil Erosion**–Takes into account such factors as typical precipitation, slope grade and length, crop rotation, conservation practices, and soil conditions.
*(Source: Calculation of the Revised Universal Soil Loss Equation (RUSLE) developed by USDA/Natural Resources Conservation Service (NRCS))*
2. **Soil Runoff Class**–Represented as a numerical value.
*(Source: USDA/NRCS)*
3. **Subsurface Drainage**–Represented as a numerical value.
*(Source: USDA/NRCS)*
4. **Leaching Potential**–Represented as a numerical value.
*(Source: USDA/NRCS)*
5. **Watershed Code**–Gives information on the priority and fragility of the watershed in which the field lies.
*(Source: Clean Water Action Plan)*
6. **Distance to Water**–Field measurements of the buffer sizes and distance from the edge of the cropping area to the surface water.
*(Source: On-site measurements)*

### Source and Management Characteristics (Part B)

Part B assigns numerical values to five factors of phosphorus loss potential due to management practices, soil test, and source characteristics:

1. **Soil Test Phosphorus**–Numerical value as expressed by the University of Maryland's FIV.
2. **Planned Phosphorus Fertilizer Application Rate**–Numerical value of the application rate for the upcoming year. Expressed as lbs $P_2O_5$ (phosphate) per acre.
3. **Phosphorus Fertilizer Application Method and Timing**–Numerical value of different application methods such as banded, injected and surface applied, and the timing of the application.
4. **Planned Organic Phosphorus Application Rate**–Numerical value of the application rate for the upcoming year. Expressed as lbs $P_2O_5$ (phosphate) per acre.
5. **Organic Phosphorus Application Method and Timing**–Numerical value of

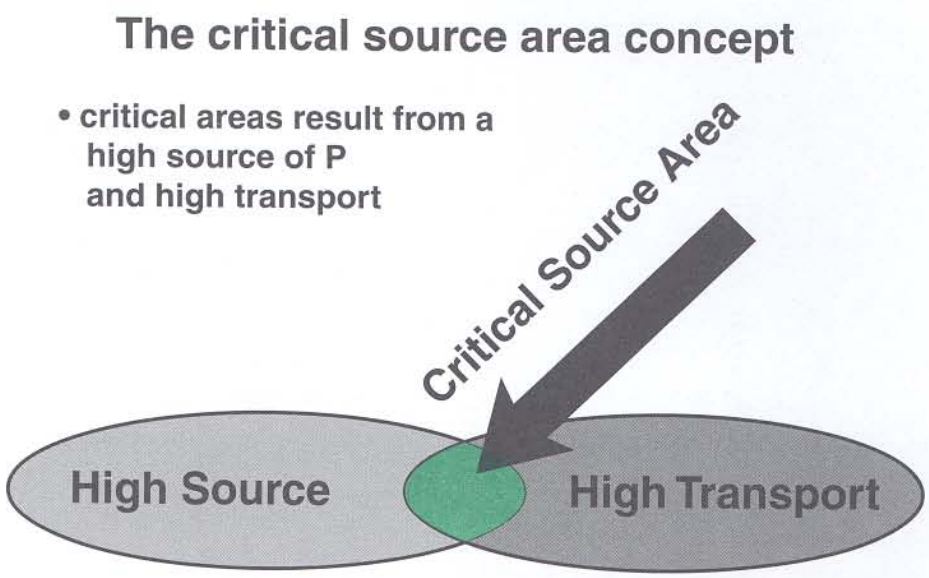



Figure 2. Critical source areas for P loss from a watershed occur where areas of high soil P and transport potential coincide. Source: USDA, Agricultural Research Service, ARS-149, July 1999.

different application methods such as banded, injected and surface applied, and the timing of the application.

## Calculating the PSI

A numerical value is determined for the six site conditions in Part A and the five farm management practices or source characteristics in Part B–a total of eleven factors. Each value indicates the relative importance of each factor in determining the phosphorus loss potential for the particular site.

The numerical values for Part A are added together and multiplied by a scaling factor. The values for Part B are summed similarly. The two sums are multiplied together to give a final PSI value from 0 to over 100. This final value indicates the potential risk of phosphorus movement from that particular field.

## Interpretation

Based on P Loss Rating, a field is placed in one of four categories–from Low to Very High. The Low rating predicts a small potential for movement of phosphorus from the field and allows for nitrogen-based nutrient management planning. Each higher rating predicts a higher potential for phosphorus movement. The higher ratings restrict the use of phosphorus and encourage the implementation of remediation techniques. See Table 1.

Certified nutrient management consultants practice measuring the slope of a field using a clinometer.

*On Tuesday, Brent and Jeff took a look at the soil test and discussed Brent's plans for this year's rotation, width of vegetative buffers, and fertilizing practices. Brent uses no-till and will plant a corn-soybean-wheat rotation. Because of the proximity of a small stream, he has planted a 25-foot buffer of grasses.*

*Brent and Jeff then drove to the field, where the consultant used a clinometer to measure the field's slope and also measured the distance from the edge of the field to the stream. The consultant told Brent that he'd have to look up a few numbers on the soil survey and watershed map, then do some calculations. He'd call back as soon as he got the information.*

*In a week, the consultant had calculated the phosphorus loss rating and found that the rating for the field was low. No changes in phosphorus management are required at this time. If manure is used as a nutrient source, the rate could be nitrogen-based.*

**Table 1. Interpretation of Phosphorus Loss Rating.**

| P loss rating | Interpretation |
|---|---|
| 0-50 | **LOW** potential for P movement from site. Nitrogen-based nutrient management planning is satisfactory. |
| 51-75 | **MEDIUM** potential for P movement. Limit P applications to amount expected to be removed from field by harvest or to soil-test P recommendations. N-based planning 1 year of 3, P-based planning 2 years out of 3. |
| 76-100 | **HIGH** potential for P movement from site. Use P-based nutrient management planning, limit P applications to expected removal or soil-test P recommendations. |
| >100 | **VERY HIGH** potential for P movement from site. No P should be applied to the site. Implement active remediation techniques to reduce P loss potential. |

### PSI Software Available for Purchase

The Maryland Phosphorus Site Index (PSI) Program will work on computers supporting Windows 95 (OSR2 or better), Windows 98, or Windows NT operating systems. To order a copy of the program, please send a check for $100.00 (per copy), payable to the University of Maryland, to the following address:

**Agricultural Nutrient Management Program**
**Office of Technology Commercialization**
**University of Maryland**
**6200 Baltimore Avenue, Suite 300**
**Riverdale, MD 20737**

## Managing for a High Phosphorus Loss Rating

- Choose crop rotations or tillage practices that reduce soil erosion. Use conservation practices such as strip cropping or contour tillage to further reduce soil erosion.
- Increase the distance from fertilized crops to bodies of water. When the soil test shows ample phosphorus available for crop growth, plan for a no-phospho-

rus application zone near water. Crops can be planted in this area, but phosphorus should not be applied.

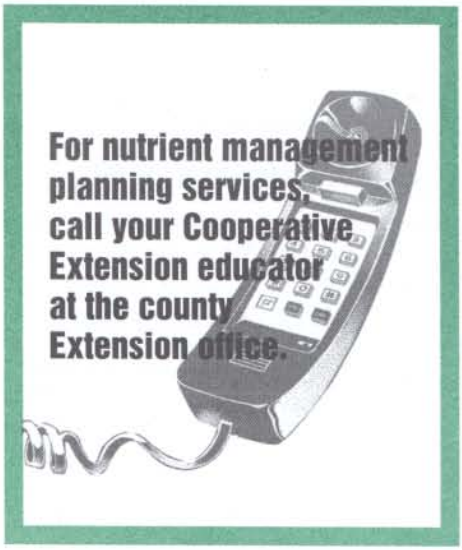
- Plant an adequate buffer strip of trees or grasses to absorb nutrients and sediment and slow the speed of water running off the field. Wide buffers reduce phosphorus losses further.
- Manage fields strategically. Time fertilizer applications to maximize nutrient uptake by plants. Incorporate material into soil as soon as practical, or within five days of application on fields where tillage is practiced.

## Resources for Further Information:

MCE Soil Fertility Management Information Series, SFM-6, "Introduction to the Maryland Phosphorus Site Index."

MCE Soil Fertility Management Information Series, SFM-7, "The Maryland Phosphorus Site Index Technical Users Guide."

**Agricultural Nutrient Management website:**
www.agnr.umd.edu/users/agron/nutrient/

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If you do not receive this newsletter by mail and would like to, contact your county Extension office or the address above. The Maryland Cooperative Extension Agricultural Nutrient Management Program is funded by the Maryland Department of Agriculture.

The photo of the clinometer on page 3 was taken by Peggy Preusch, and the photo of water on page 1 was taken by David Marsland.

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