Phosphorus soil test trends in NW Ohio and the potential for stratification of phosphorus within the soil profile.

Phosphorus Task Force Meeting
May 23, 2007

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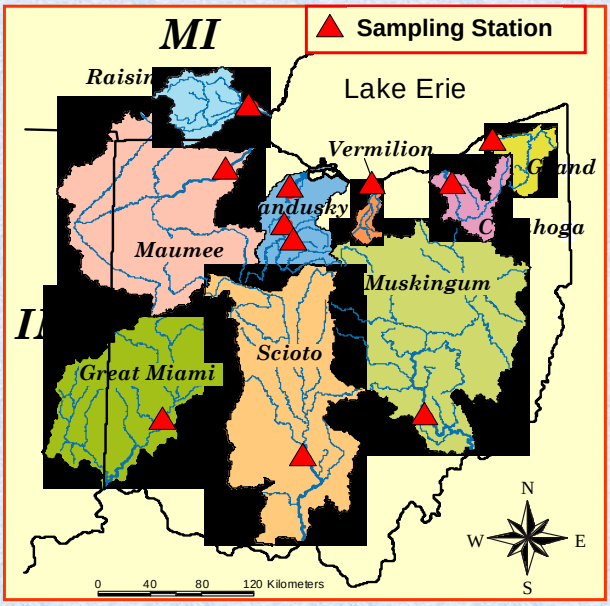
The Ohio Tributary Loading Program

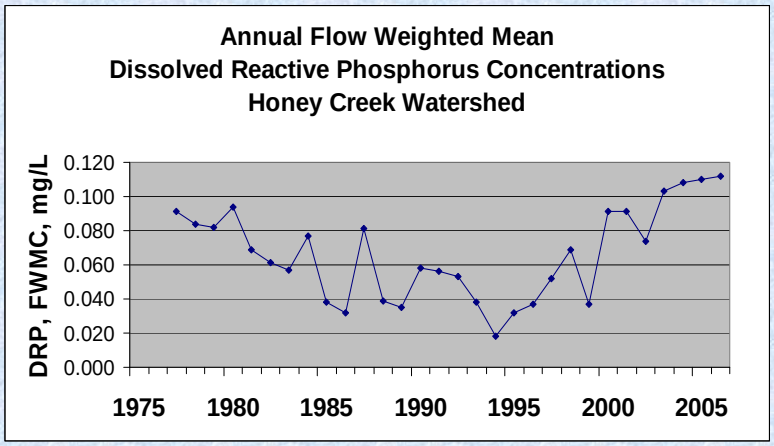


Program started by Heidelberg College in 1974 for Lake Erie tributaries

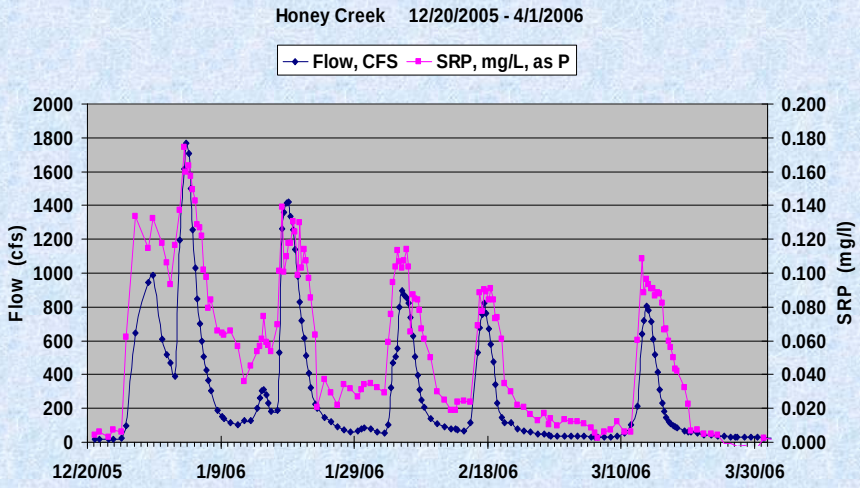
Currently automatic sampler collections at nine U.S. Geological Survey Stream Gages

Major support from the Division of Soil and Water Conservation, ODNR

DRP concentrations were in decline but have begun to increase since the mid 1990's . . .



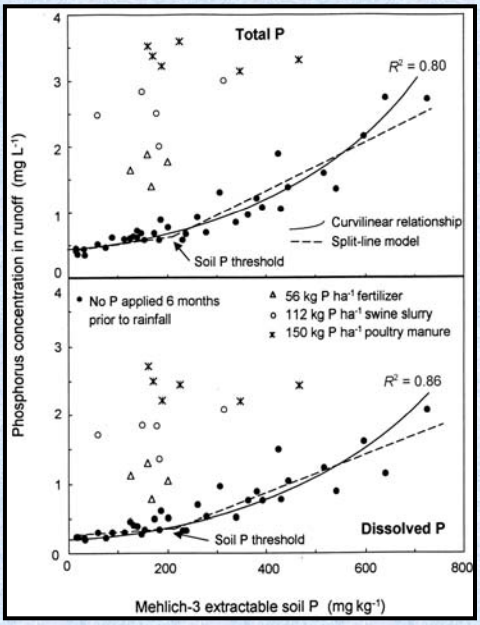
Peaks in dissolved phosphorus now coincide with peaks in storm runoff, especially in winter . . .



What insight might past research provide?

"There is ample evidence that the phosphorus concentrations in water runoff and eroded sediment increase as the soil test level of the surface two inches of soil increase".

Voss and Griffith. 1998. Iowa State University. "Phosphorus and Surface Water" for Illinois Fertilizer and Chemical Association



Relationships Between Soil Test Levels and Runoff Concentrations of DP and TP

(Sharpley et al. JEQ, 2001)

"The potential for P loss from both surface runoff and, in some situations, subsurface leaching increases as soil test levels exceed the critical soil test values* established for crop needs". (Sharpley et al. 1996)

Critical values for OH, MI and IN crops . . .

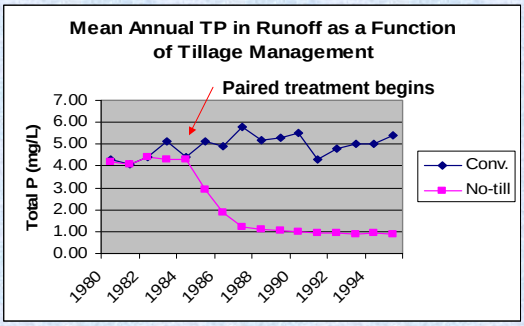
	Bray P-1, ppm	Bray P-1, lbs/ac
Corn	15	30
Soybeans	15	30
Wheat	25	50
Alfalfa	25	50

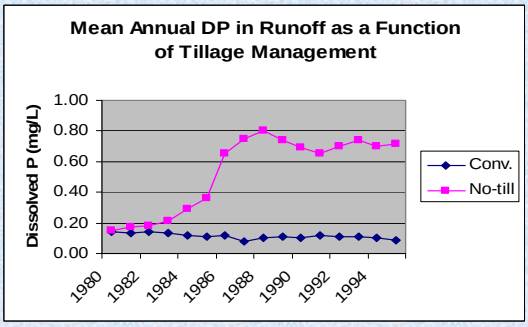
*The soil test level above which the soil can supply adequate quantities of nutrient to support optimum economic growth.

Conservation tillage (lack of moldboard plowing) can result in the stratification of P near soil surface . . .

Percent increase in soil test P (Bray P-1, lbs/ac) in the upper 2 to 3 inches of the soil profile after long term (7 to 20 years) tillage studies:

Long Term Study	Plow	Chisel	(% Incr.)	No-till	(%Incr.)
U of Missouri	49	121	(247)	168	(343)
Ohio State U	74	170	(230)	180	(243)
Iowa State 1	58	101	(174)	141	(243)
Iowa State 2	66	124	(188)	132	(200)
Miss. State	78	172	(221)	182	(233)
Average Long Term Increases:			(212%)		(253%)



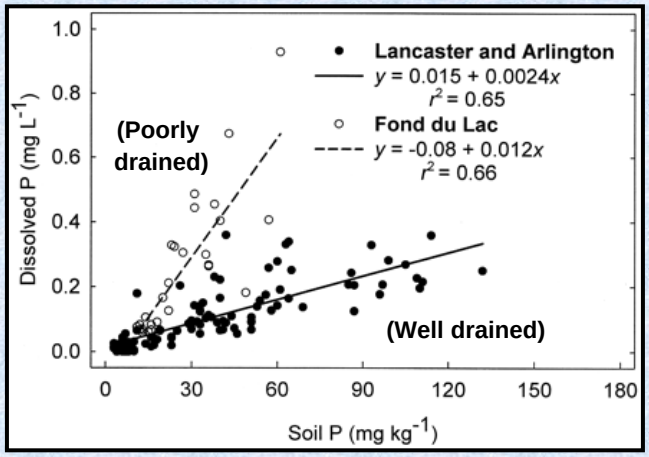


Reducing tillage can decrease TP in runoff …

…but it can increase DP in runoff.

(Sims and Kleinman. 2006. <u>Phosphorus.</u>)

Under conservation tillage and for a given soil test P, DP concentrations are greater in runoff from more poorly drained soils. **(Andraski and Bundy. 2003. U of Wisc.)**



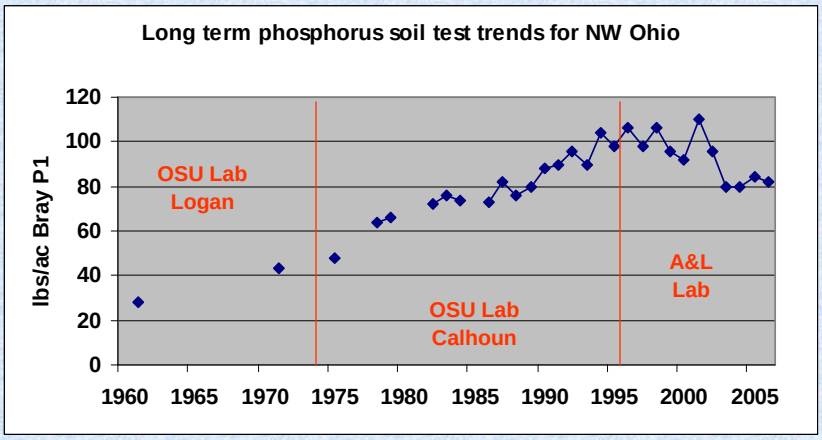
What evidence is there that cropland soil test P levels may be high?

"In Ohio, 42% (Michigan, 30%; Indiana, 24%) of soil samples show the need for annual P fertilization (below critical level) to avoid profit losses for major crops".

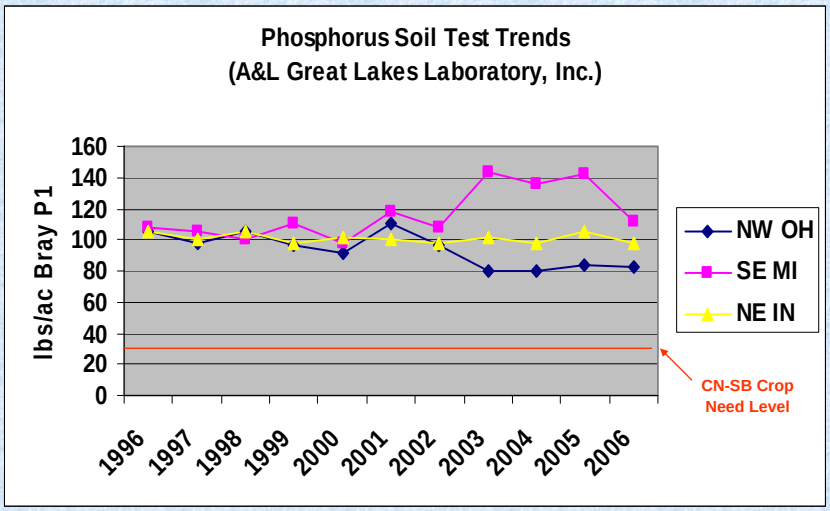
"In Ohio, Michigan and Indiana there was no change in typical soil test levels from 2001 to 2005".

Fixen et al. 2005. Potash and Phosphate Institute.

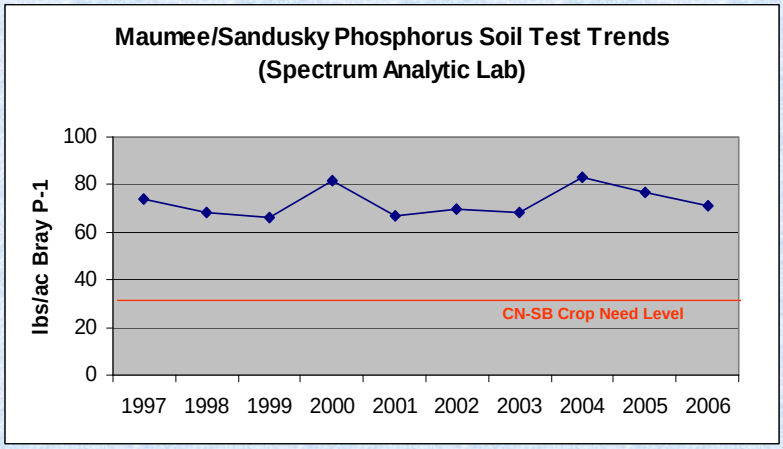
What does long term phosphorus soil test data suggest?



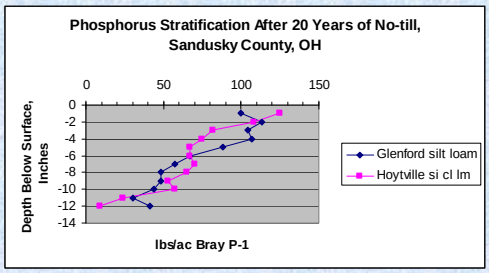
What does current phosphorus soil test data suggest?



Similar data from a different laboratory . . .



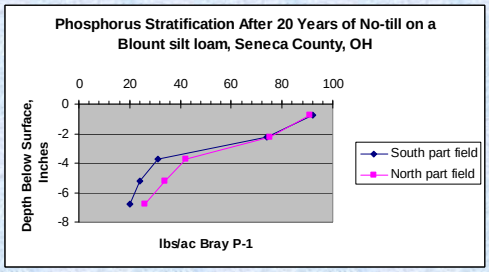
Initial results of local stratified P soil testing . . .



Standard 8 inch soil test:

Glenford	**86 lbs/ac**
Hoytville	**82 lbs/ac**

Jerry Cunningham, CCA
Country Spring Farmers Co-op.

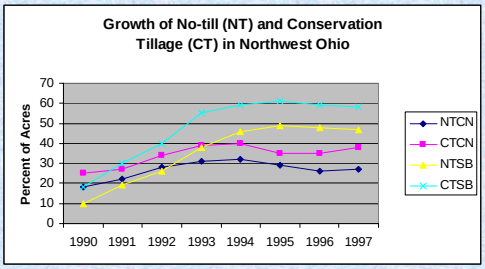


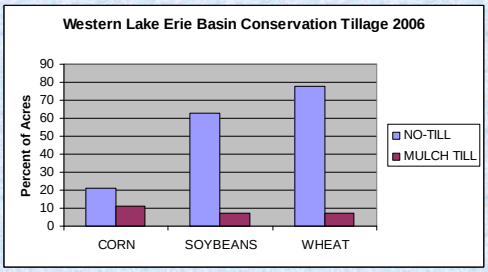
Standard 8 inch soil test:

South field	**48 lbs/ac**
North field	**54 lbs/ac**

Bill McKibben, CCA
Logan Labs

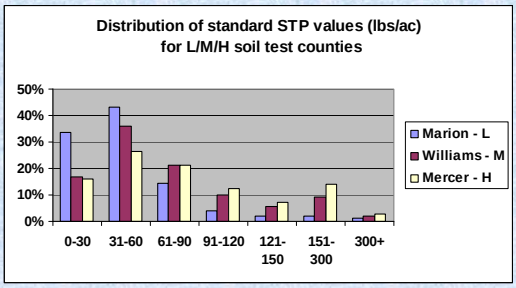
Conservation tillage growth in Northwest Ohio . . .

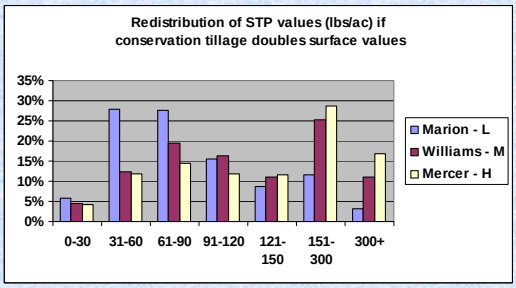




(Compiled by Steve Davis, USDA-NRCS)

Potential changes in P soil test values at soil surface . . .





(Spectrum Analytic Lab, 2003)

Summary:

* Peaks in DRP concentrations now coincide with storm events.
* DRP concentrations are a function of soil test P values in the absence of contributions by fertilizers or manures.
* More than half of standard soil test P values exceed levels required for optimal crop production.
* Conservation tillage can elevate soil test P values at or near the soil surface.
* Elevated soil test P levels on poorly drained soils further increase the potential for DRP in runoff.
* DRP increases in tributaries began at the same there were increases in conservation tillage adoption.
* A doubling of soil test P values near the soil surface would increase the potential for DRP in runoff, especially in areas where standard soil test values were already high.