Supplementary Materials

Table S1. Soil characteristics of fields monitored for edge-of-field P losses.

Field	Primary soil series*	Primary soil texture class†	Slope‡ %	Soil organic matter§ %	pH§
A1	Hoytville	Silty clay loam	0.5	4.3	6.1
A2	Hoytville	Silty clay loam	0.7	4.1	6.4
B1	Hoytville, Nappanee	Silty clay loam	0.7	3.2	6.3
B2	Hoytville	Silty clay loam	0.5	3.5	5.6
C1	Blount, Haskins	Loam	3.4	3.9	6.8
C2	Haskins	Loam	3.4	2.0	7.1
D1	Miamian, Sloan, Westland	Silt loam	2.7	4.2	7.4
D2	Crosby, Kokomo	Silt loam	2.7	3.5	7.5
E1	Paulding	Clay	0.5	5.0	6.5
E2	Paulding	Clay	0.5	5.1	6.3
F1	Blount, Luray, Tiro	Silt loam	1.4	3.5	6.6
F2	Luray, Tiro	Silt loam	0.4	3.3	6.6
G1	Blount	Silt loam	2.3	4.5	7.4
H1	Hoytville	Silty clay loam	0.5	4.2	6.8
H2	Hoytville	Silty clay loam	0.5	4.4	6.5
J1	Hoytville, Nappanee	Silty clay loam	1.2	3.5	6.2
J2	Hoytville, Nappanee	Silty clay loam	1.2	3.1	6.8
K1	Blount	Silt loam	2.5	3.4	6.7
K2	Blount	Silt loam	2.5	3.7	6.3
L1	Hoytville, Nappanee	Silty clay loam	0.7	3.4	6.6
L2	Hoytville, Nappanee	Silty clay loam	0.7	3.0	6.4
M1	Hoytville	Silty clay loam	0.5	3.8	6.9

M2	Hoytville	Silty clay loam	0.5	3.6	6.6
N1	Hoytville, Mermill	Clay loam	0.5	2.9	6.4
N2	Hoytville, Mermill	Clay loam	0.5	3.6	6.3
O1	Bennington, Pewamo	Silt loam	1.8	4.3	7.0
O2	Bennington, Pewamo	Silt loam	1.8	3.4	6.7
P1	Centerburg	Silt loam	5.1	4.0	6.0
P2	Centerburg	Silt loam	4.2	3.9	5.2
Q1	Hoytville	Clay loam	0.5	4.0	5.8
Q2	Hoytville	Clay loam	0.5	4.3	6.1
R1	Latty, Nappanee	Silty clay loam	0.7	3.6	7.1
R2	Paulding, Roselms	Clay	1.8	4.1	6.7
S1	Blount, Pewamo	Silt loam	1.9	4.3	5.6
S2	Blount, Pewamo	Silt loam	1.9	3.7	7.0
T1	Blount	Silt loam	1.3	4.0	6.2
T2	Blount, Milford	Silt loam	1.3	4.4	6.2

* Soil series occupying 20% of area are listed; series were identified with maps produced by the USDA-NRCS National Cooperative Soil Survey

† USDA-NRCS soil texture class definitions

‡ Slope was calculated as the weighted average of soil map units

§ 0-20 cm sample depth; field averages were calculated as the simple average of multiple discrete observations in each field taken in Sept-Dec 2017

Table S2. Initial values and changes (delta) in soil test phosphorus (STP), CV of STP, and P stratification ratio (P_{strat}) between subsequent soil sampling events within fields. Management practices (P rate, P form, and tillage) occurring between the water quality monitoring windows associated with each soil sampling event are also shown.

Field	Initial STP 0-5 cm	Initial STP 0-20 cm	Initial P_{strat}	CV 0-5	CV 0-20	delta STP 0-5	delta STP 0-20	delta CV 0-5	delta CV 0-20	delta P_{strat}	Time elapsed	P applied	P Form*	Tillage
	mg P kg^{-1}	mg P kg^{-1}		%	%	mg P kg^{-1}	mg P kg^{-1}	%	%		d	kg P ha^{-1}		
A1	114.4	70.3	1.79	29.1	42.3	-3.6	-5.6	20.9	25.2	0.19	0	0.0	.	N
N2	96.1	80.6	1.22	18.1	20.3	-10.0	-9.3	-0.8	-7.6	0.02	1	0.0	.	N
P1	18.9	21.3	1.90	25.8	29.2	3.4	-3.5	28.1	20.7	-0.64	283	47.5	M&C	N
P2	38.2	11.8	2.34	20.9	61.0	-2.5	9.8	3.3	-35.2	-0.31	379	21.6	C	N
Q1	26.9	20.9	1.39	14.6	30.6	4.0	3.9	1.8	-2.9	-0.07	1	0.0	.	N
Q1	30.9	24.9	1.37	16.3	27.8	6.5	5.4	-2.4	-6.0	-0.01	1	0.0	.	N
Q2	31.9	27.1	1.24	28.0	27.5	13.5	7.4	4.6	-3.5	0.22	1	0.0	.	N
Q2	28.3	21.5	1.43	31.1	33.7	3.6	5.6	-3.0	-6.2	-0.22	1	0.0	.	N
B1	24.3	19.7	1.39	20.5	24.4	22.1	11.3	28.0	21.5	0.46	781	49.8	C	Y
B2	42.9	30.7	1.58	39.9	52.6	16.1	4.7	-26.1	-38.6	0.53	781	49.8	C	Y
C1	57.7	29.6	2.58	48.0	56.3	4.0	6.8	-23.2	-30.5	-0.64	575	43.8	C	Y
C2	47.6	23.1	2.83	34.9	31.9	-4.1	1.6	4.8	6.2	-0.83	575	43.8	C	Y
D1	63.6	53.7	1.17	31.9	42.6	9.4	7.6	7.0	1.6	0.01	34	0.0	.	Y
D2	50.8	40.7	1.25	43.4	57.1	-12.4	-19.7	-23.5	-36.6	0.15	34	0.0	.	Y
E1	53.0	30.9	2.02	20.7	24.9	15.7	9.6	-2.1	0.8	-0.04	0	35.7	M	Y
E2	54.2	30.2	2.18	8.4	13.4	14.6	12.3	0.5	2.4	-0.40	0	35.7	M	Y
F1	45.7	34.5	1.38	34.3	48.9	-9.5	-7.2	23.8	25.2	0.00	552	22.9	C	Y
F2	43.5	24.8	1.95	23.6	29.3	-11.3	0.7	15.4	10.6	-0.95	710	22.9	C	Y
G1	165.2	124.0	1.27	35.3	40.0	26.1	25.7	-9.8	-5.0	-0.09	21	7.5	M	Y
G1	142.1	120.8	1.19	41.0	41.7	23.1	3.2	-5.8	-1.6	0.25	176	40.2	M	Y
H1	76.0	36.0	2.96	14.5	17.5	4.0	5.3	17.8	15.3	-0.54	223	17.5	C	Y
H2	80.4	41.7	2.37	27.5	26.9	0.9	0.7	-0.6	9.1	-0.03	223	17.5	C	Y
J1	45.4	35.6	1.34	82.7	107.9	0.6	-5.7	-52.7	-77.9	0.47	39	26.4	C	Y

J2	46.1	29.0	1.78	54.7	60.3	-1.6	-4.1	-3.6	-1.3	0.45	39	26.4	C	Y
K1	65.9	42.6	1.80	18.0	19.9	10.9	6.0	13.1	16.9	0.06	379	105.7	M&C	Y
K2	74.1	49.0	1.73	20.8	23.3	10.9	11.3	1.6	10.0	-0.19	379	105.7	M&C	Y
L1	69.1	50.3	1.39	17.6	17.3	3.6	-4.0	6.7	12.3	0.37	216	56.8	M&C	Y
L2	71.8	46.9	1.71	13.2	26.9	0.4	-9.4	14.4	8.1	0.93	216	56.8	M&C	Y
M1	64.6	42.1	1.87	47.1	42.6	10.9	12.1	-11.4	-3.8	-0.27	354	17.1	M	Y
M1	75.5	54.2	1.60	35.7	38.8	-15.3	-7.3	3.9	1.1	-0.18	46	18.5	M	Y
M2	34.1	20.9	2.06	12.6	20.3	15.9	18.0	-1.4	-6.3	-0.64	354	17.1	M	Y
M2	50.0	39.0	1.42	11.2	14.1	4.4	3.4	7.7	-5.0	0.00	46	18.5	M	Y
M3	84.8	56.8	1.79	1.9	0.9	-2.9	2.8	36.8	42.1	-0.22	354	17.1	M	Y
M3	81.8	59.6	1.57	38.8	43.1	1.8	1.7	-5.2	-3.7	-0.02	46	37.0	M	Y
M4	43.7	34.1	1.41	37.5	32.1	27.0	13.4	13.8	27.9	0.36	354	17.1	M	Y
M4	70.7	47.5	1.77	51.4	60.1	-5.0	2.8	1.6	-8.8	-0.32	46	18.5	M	Y
N1	91.1	74.8	1.22	13.7	14.4	-1.9	-31.3	33.8	18.7	1.87	137	46.4	C	Y
N1	89.2	43.5	2.86	47.5	33.1	-41.0	-9.9	-23.1	-3.8	-1.50	134	22.0	C	Y
N2	86.1	71.2	1.24	17.4	12.6	-13.6	-31.7	23.3	31.9	1.24	323	31.4	C	Y
O1	45.4	33.4	1.46	21.4	18.2	7.5	3.8	12.5	21.6	0.11	16	0.0	.	Y
O1	52.9	37.2	1.60	33.9	39.9	-14.3	-13.9	15.5	10.0	0.46	15	12.7	C	Y
O2	55.2	40.3	1.46	24.4	28.0	-10.7	-11.8	3.4	2.3	0.35	16	0.0	.	Y
O2	44.4	28.6	1.84	27.8	30.4	-12.9	-8.8	0.7	-2.1	0.07	15	12.7	C	Y
R1	57.3	35.8	1.91	75.0	83.0	33.3	24.6	-37.6	-27.5	-0.20	329	35.4	M&C	Y
R2	27.7	18.2	1.71	22.8	29.1	14.9	6.3	21.7	17.7	0.47	524	33.0	C	Y
S1	100.1	81.2	1.31	42.9	59.3	101.6	18.6	8.1	-4.2	1.73	264	48.4	M&C	Y
S1	201.7	99.8	2.88	51.0	55.1	-51.8	12.0	-23.1	-18.2	-1.55	48	70.9	M&C	Y
S2	115.5	74.8	1.69	6.2	7.2	18.2	9.0	22.8	28.5	0.10	652	119.3	M&C	Y

* M=manure, C=chemical P fertilizer

Table S3. Linear regression results for field maximum STP vs. FWM P concentrations. Regressions were performed on natural log transformed FWM P concentrations. Results can be compared with those in Table 3.

	------- DRP -------				------- TP -------			
	Regression slope*	Regression intercept*	R^2	RMSE	Regression slope*	Regression intercept*	R^2	RMSE
Surface runoff								
0-5 cm samples	0.007	-2.60	0.14	0.74	0.005	-0.98	0.14	0.47
0-20 cm samples	0.006	-2.34	0.07	0.77	0.005	-0.87	0.11	0.48
Tile drainage								
0-5 cm samples	0.009	-3.85	0.38	0.59	0.005	-1.86	0.18	0.51
0-20 cm samples	0.010	-3.70	0.31	0.62	0.005	-1.73	0.10	0.53

* P concentration data were log transformed prior to regression; all regression slopes and intercepts were significant at the $P<0.01$ level.