Monitoring Trends in Soil Phosphorus through Conversion of Cropland to Prairie on the former Acker Farm

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2020 Progress Report

Soil samples were collected on the former Acker farm by Dane County Land & Water Resources staff Matt Diebel and Laurie Lambert on October 6 and 9, 2020. This was the first sample set of what is planned to be a long-term study. At the time of sample collection, earth moving to create water retention berms was in progress, but none of the sample locations were in the disturbed area. Crops were all harvested prior to sample collection and there had been very little rain for about a month prior to sample collection. Soils were generally hard and required significant pressure to penetrate with a 1" diameter soil corer. One of the sampling sites (5-1) was moved from its original location because it was on the edge of the road ditch. A Google map of the sampling locations on an iPhone was used to locate sample points. Overall, this first sampling event was a success and supports continued monitoring with consistent methods to assess long-term changes in soil phosphorus.

Samples were collected at points depicted in Figure 1. At each point, at least 10 6-inch deep cores were collected from random locations within a 10-foot radius around the point. To assess P stratification, each core was divided into the top 2 inches and the bottom 4 inches. The top and bottom sections were then composited separately, created a single top sample and a single bottom sample for each point. Soil samples were analyzed for soil test phosphorus (P), potassium (K), pH, and organic matter by the UW Soil and Forage Laboratory in Marshfield and for total P by the Wisconsin State Lab of Hygiene.

Area-weighted mean soil test P on the former Acker farm in 2020 was 296 parts per million (ppm), which is significantly lower than the value of 318 ppm in 2016 (two-tailed paired t-test by field, $n=11$, $p = 0.03$), though still extremely high for cropland in Dane County. Soil test P decreased in all but one of the fields (Table 1). The large decrease in soil test P in field 400 may be because the sample(s) collected in 2016 were closer to field 11 than the 2020 sample point. The fields with the lowest soil test P (4, 8, and 12) are on the highest ground.

Mean soil test P was slightly higher in the 2-6 inch fraction of cores (295 ppm) than in the 0-2 inch fraction (287 ppm), but the difference was not significant (two-tailed paired t-test by point, $n=26$, $p = 0.08$). Similarly, mean total P was slightly higher in the 2-6 inch fraction of cores (1175 mg/kg) than in the 0-2 inch fraction (1161 mg/kg), but the difference was not significant (two-tailed paired t-test by point, $n=26$, $p = 0.64$). Organic matter was significantly higher in the 0-2 inch fraction of cores (4.1%) than in the 2-6 inch fraction (3.4%, two-tailed paired t-test by point, $n=26$, $p < 0.001$). Future sampling should continue to assess P and organic matter

stratification; they may change because manure is no longer being applied and prairie plants may vertically redistribute P and organic matter.

Table 1. Comparison of 2016 and 2020 soil test P in fields on the former Acker farm.

Field	2016 Soil Test P	2020 Soil Test P	Change
3	281	279	-2
4	251	202	-49
5	290	259	-31
6A	339	326	-13
6B	295	299	+4
7	327	291	-36
8	272	246	-26
10	313	233	-80
11	526	477	-49
12	217	129	-88
400	550	295	-255

Figure 1. Sample grid and points for the Acker farm. Field boundaries were buffered in by 30 feet to avoid possibly atypical soil conditions. Fields were then trimmed to exclude areas in the permanent pool of the wetland basins. Remaining areas were then divided into approximately equal areas no greater than 5 acres by hand digitizing. Sample points were created in each grid cell with the Create Random Points tool in ArcGIS.

Field	Site	Depth	pH	Soil Test P	TP	K	OM%
3	1	2	7.36	212	748	241	3.0
3	1	6	7.32	218	813	213	2.9
3	2	2	7.33	237	968	269	3.5
3	2	6	7.33	228	982	273	3.4
3	3	2	7.30	237	943	298	3.5
3	3	6	7.26	225	1050	267	3.5
3	4	2	7.29	310	1060	253	3.3
3	4	6	7.19	344	1130	247	3.2
3	5	2	7.09	356	971	203	3.1
3	5	6	7.11	365	1160	214	3.2
3	6	2	7.30	319	1280	304	3.5
3	6	6	7.34	299	1190	311	3.2
4	1	2	7.33	177	874	249	3.4
4	1	6	7.31	176	835	191	2.9
4	2	2	7.29	237	939	272	3.3
4	2	6	7.28	224	914	219	2.9
5	1	2	7.42	248	1040	239	3.4
5	1	6	7.32	264	1030	162	2.7
6A	1	2	7.32	337	1320	312	4.3
6A	1	6	7.29	341	1410	340	4.0
6A	2	2	7.39	329	1350	364	4.2
6A	2	6	7.36	334	1340	353	4.0
6A	3	2	7.31	312	1390	310	3.6
6A	3	6	7.29	302	1300	346	3.2
6B	1	2	7.34	302	1060	280	3.5
6B	1	6	7.28	298	1200	270	3.3
7	1	2	7.30	298	1190	330	3.7
7	1	6	7.24	307	1200	340	3.3
7	2	2	7.35	298	1230	329	3.6
7	2	6	7.20	326	1220	298	3.5
7	3	2	7.32	249	1200	358	3.3
7	3	6	7.25	242	1250	284	2.9
7	4	2	7.21	291	1110	343	3.8
7	4	6	7.18	301	1430	322	3.6
8	1	2	7.27	216	992	235	4.3
8	1	6	7.27	240	1080	134	3.7
8	2	2	7.14	286	1230	286	4.7
8	2	6	6.99	337	1330	179	3.9
8	3	2	6.95	179	817	250	3.9
8	3	6	6.81	189	703	114	2.7
10	1	2	7.06	244	1170	259	4.8
10	1	6	6.88	227	1030	194	3.4
11	1	2	7.02	365	1550	261	5.7
11	1	6	7.00	401	1670	222	5.1
11	2	2	6.91	585	2280	178	8.3
11	2	6	7.20	656	2500	179	5.5
11	3	2	7.12	382	1380	130	5.4
11	3	6	7.14	423	1130	91	3.3
12	1	2	7.37	136	864	179	3.5
12	1	6	7.40	125	809	126	2.6
400	1	2	6.72	314	1230	142	5.7
400	1	6	7.14	285	835	254	2.1