

ANALYSES OF ONE HUNDRED SOILS IN ALLEN COUNTY, INDIANA.

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The soils of Indiana present about as varied types and are as different in fertility as any that can be found. They include such famous areas as the sand dunes about Valparaiso, the peppermint fields of Mishawaka, and the limestone country about Bedford. There is quite a difference in soils not only between neighboring counties but even between adjacent farms, differences which the casual observer seldom notices, because to him all soils look alike and are "just dirt."

CALLING THE "SOIL DOCTOR."

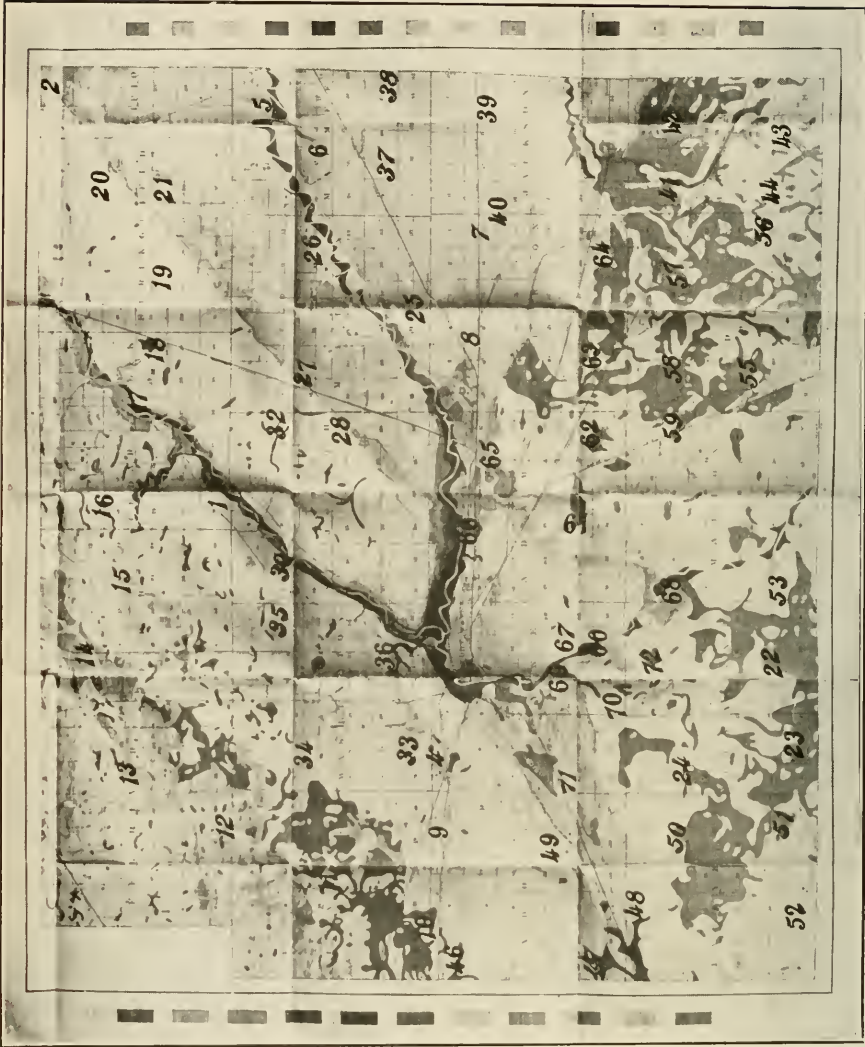
Soils are usually studied only after a series of failures of wheat, clover, etc., and the question naturally arises, "Why can I not grow crops like father used to?" It is at this stage of the soil's depletion that the "soil doctor" is called often to prescribe for the sick soil. The ability of the doctor to diagnose the case through analysis has been overestimated somewhat in the popular mind. Nevertheless it usually gives the best answer as to why the wheat or clover failed to do well. Of all the soils investigated in this county by the writers, it was found that, where the physical conditions permitted, the crop yield was closely related to the amount of organic matter and plant food present, as shown in the graphs which follow.

VALUE OF SOIL ANALYSIS.

One reason for the questioning by many scientific men the value of analysis as a means of measuring fertility, is the varying results in pot and field work and the inability to correlate or interpret the results with the known composition of the soil. The conflicting results are often due to artificial surrounding conditions or to the use of seed of variable vitality, etc. Hence it was the purpose of this investigation to visit the growing plant, especially corn, in its natural home and there seek the reason of its good growth or the cause of its failure.

PLAN OF INVESTIGATION.

All the soils studied were secured in Allen County. They are of glacial origin, 70% belonging to the Miami series and 18.5% to the



Soil Map, Allen County, Indiana.

Clyde series. The samples, 100 in all, were taken from all parts of the county and from the various soil types. Many conditions were noted when the samples were taken (September, 1917), as the condition of the crops, prevalent weeds, trees, etc. Information as to the use of lime fertilizer, crop yield, was obtained from the man in charge of the farm. The following data was obtained by analysis: First, amount of volatile organic matter; second, per cent of phosphorus; third, per cent of nitrogen; fourth, presence of carbonates and acidity of the soil to litmus paper. The data from these soils is recorded in the tables which follow:

DISCUSSION OF TABLES.

It will be noticed from the tables that there are many soils of this county quite high in organic matter, only 11% being below 4%, while 45% range from 4 to 7%; 37% range from 7 to 15%, and 6% are above that amount. It might be expected that this high organic content would carry a considerable amount of nitrogen, and this was found to be the case. Every per cent of increase in organic matter carried with it an increase of 519 pounds of nitrogen and 72 pounds of phosphorus per acre. This is much less phosphorus than is to be expected in these soils, and in most cases they would respond profitably to an application of that fertilizer. It is shown in Charts 1 and 2 that nitrogen has more to do with high corn yield than phosphorus. There is a serious lack of calcium carbonates in over half of the soils tested; 55% are acid to litmus. This condition makes a good clover stand nearly impossible and is the main cause of "clover sickness" frequently reported.

TABLE I.

Organic Matter 0 to 4%. Nitrogen and Phosphorus Content.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
25	2.19	43,800	.0714	1,428	.0827	1,654
3°	4.00	80,000	.1834	3,668	.0781	1,562
35°	1.66	33,200	.2226	4,452	.0660	1,320
14°	1.75	35,000	.2002	4,004	.0946	1,892
16°	3.40	68,000	.1106	2,212	.0410	1,820
17°	4.00	80,000	.2122	4,244	.0990	1,978
235	3.81	76,200	.0840	1,680	.0754	1,508
27°	3.66	73,200	.1414	2,828	.0722	1,444
285	4.01	80,200	.0980	1,960	.0930	1,860
45°	3.72	74,400	.2525	5,050	.0740	1,480
475°	3.47	69,400	.2240	4,480	.0800	1,600
		68,433		3,667		1,696 ave.

This group constitutes 11% of total.

°—Acid condition.

TABLE II.

Organic Matter 4 to 5%. Nitrogen and Phosphorus Content of This Group.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
1°	4.56	91,200	.1792	3,584	.0822	1,644
7s	5.04	100,000	.1064	2,128	.0647	1,294
11°	4.70	94,000	.4270	8,540	.0585	1,170
13	4.80	96,000	.2534	5,064	.1131	2,262
19s°	4.29	85,800	.3038	6,076	.0552	1,104
26s	4.97	99,400	.0602	1,204	.0808	1,616
32°	4.91	98,200	.1570	3,140	.0848	1,696
33	4.53	90,600	.1428	2,856	.0808	1,616
35°	4.91	98,200	.2030	4,060	.0849	1,698
36°	4.11	82,200	.1470	2,940	.0808	1,616
37s	4.91	98,200	.1498	2,996	.0808	1,616
41s°	4.43	88,600	.1939	3,878	.0740	1,480
56s°	4.78	95,600	.1386	2,772	.0657	1,314
65s	4.75	95,000	.0798	1,596	.0983	1,966
14s°	4.03	80,600	.0900	1,800	.0552	1,104
		92,914		4,312		1,671 ave.

s—Subsoil. This group constitutes 15% of total.

°—Acid condition.

TABLE III.

Organic Matter 5 to 6%. Nitrogen and Phosphorus Content of Group.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
9°	5.49	109,800	.1624	3,248	.0754	1,508
15	5.17	103,400	.2688	5,376	.0768	1,536
18°	5.72	114,400	.1909	3,818	.0916	1,832
20°	5.20	104,000	.1764	3,528	.0935	1,870
31°	5.21	104,200	.1796	3,592	.0889	1,778
34°	5.57	111,400	.1746	3,482	.0795	1,590
35s°	5.60	112,000	.2058	4,116	.0687	1,374
38s	5.22	104,400	.1232	2,464	.0970	1,940
62°	5.04	100,800	.2366	4,732	.0949	1,898
64s	5.14	102,800	.1274	2,548	.1360	2,720
67°	5.41	108,200	.1092	2,184	.1104	2,204
67s	5.21	104,200	.0952	1,904	.1063	2,126
44°	5.91	118,200	.1890	3,780	.0957	1,914
53	5.46	109,200	.3052	6,104	.1582	3,164
25°	5.23	104,600	.1820	2,640	.0808	1,616
		108,018		3,658		1,764 ave.

s—Subsoil. This group constitutes 15% of total.

°—Acid condition.

TABLE IV.

Organic Matter 6 to 7%. Nitrogen and Phosphorus Content of Group.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
2°	6.08	121,600	.2226	4,452	.1147	2,294
9s	6.33	126,600	.1008	2,016	.0741	1,482
23°	6.25	125,000	.2184	4,368	.1066	2,132
26°	6.99	139,800	.0644	1,288	.1082	2,164
60s°	6.49	129,800	.2100	4,200	.0902	1,804
62s°	6.06	121,200	.1848	3,696	.0687	1,374
64	6.00	120,000	.1694	3,388	.1360	2,720
70°	6.93°	138,600	.1484	2,968	.1010	2,020
41	6.63	132,600	.3164	6,328	.0701	1,402
43°	6.62	132,400	.2254	4,508	.2760	5,520
43s°	6.89	137,800	.0840	1,680	.0625	1,250
51°	6.95°	139,000	.1890	3,780	.0943	1,886
52°	6.77°	135,400	.1512	3,024	.1010	2,020
55	6.10	122,000	.2380	4,760	.1002	2,004
61°	6.39	127,800	.2212	4,424	.0833	1,266
		130,309		3,935		2,312

s—Subsoil. This group constitutes 15% of total.

°—Acid condition.

TABLE V.

Organic Matter 7 to 9%. Nitrogen and Phosphorus Content of Group.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
7°	7.19	143,800	.3136	6,270	.0016	1,832
19	7.37	147,400	.2828	5,656		
21	7.46	149,200	.2590	5,180	.1065	2,130
28°	7.45	149,000	.2576	5,152	.0983	1,966
65°	7.63°	152,600	.1974	3,948	.1320	2,640
49°	7.78°	155,600	.2766	5,532	.0746	1,492
50	7.07°	141,400	.2100	4,200	.0956	1,912
8	8.79	175,800	.3094	6,188	.0867	1,734
4s	8.67	173,400	.2026	4,052	.1119	2,238
47	8.57°	171,400	.3220	6,440	.1015	2,030
52s	8.84°	176,800	.0826	1,652	.0741	1,482
54s	8.97°	179,400	.1604	3,208	.0680	1,360
56	8.46°	169,200	.2716	5,432	.0956	1,912
70s	8.63	172,600	.0840	1,680	.0875	1,750
72s	8.18°	163,600	.0826	1,652	.0875	1,750
22°	8.29	165,800	.2926	5,852	.1441	2,882
24°	8.28	165,600	.2226	4,452	.1199	2,398
29	8.57	171,400	.2828	5,656	.0983	1,966
		158,323		5,366		2,074 ave.

s—Subsoil. This group constitutes 18% of total.

°—Acid condition.

TABLE VI.

Organic Matter 9 to 11%. Nitrogen and Phosphorus Content.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
5°	9.62	192,400	.3127	6,254	.1322	2,644
6	9.10	182,000	.3746	7,492	.0970	1,940
39	9.60	192,000	.2910	5,880	.1227	2,454
54	9.29	195,800	.2912	5,824	.1536	3,072
38	9.90	198,000	.3312	6,624	.1146	2,292
4	10.32	206,400	.5012	10,024	.1359	2,718
57°	10.00	200,000	.3808	7,616	.1110	2,220
60	10.34	206,800	.3038	6,076	.1150	2,300
72	10.44	208,800	.1876	3,752	.1027	2,054
50s	10.10	202,000	.1218	2,435	.0647	1,294
		196,911		6,615		2,410 ave.

s—Subsoil. This group constitutes 10% of the total.

°—Acid condition.

TABLE VII.

Organic Matter 11 to 15%. Nitrogen and Phosphorus Content.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
40	11.07	221,400	.3780	7,560	.1165	2,330
48	11.07	221,400	.1386	2,772	.1038	2,076
66	11.15	223,000	.2562	5,124	.1027	2,054
58	12.07	241,400	.2786	5,572	.0916	1,832
63°	12.21	244,200	.2968	5,936	.1388	2,776
10s	12.62	252,400	.3248	6,496	.0983	1,966
59	12.86	257,200	.3858	7,716	.1616	3,232
46	13.65	273,000	.4998	9,996	.2810	5,620
30	14.26	285,200	.4284	8,568	.1145	2,290
		245,850*		6,655		2,779 ave.

s—Subsoil. This group constitutes 9% of total.

*—1,000,000 lbs. per acre 6 $\frac{2}{3}$ ms.

°—Acid condition.

TABLE VIII.

Organic Matter from 15 to 79%. Nitrogen and Phosphorus Content of Group.

Sample No.	Per Cent. Organic Matter	Lbs. per Acre	Per Cent. Nitrogen	Lbs. per Acre	Per Cent. Phosphorus	Lbs. per Acre
69s	17.80	356,000	.0596	1,192	.1037	2,074
10	21.45	429,000	.4656	9,312	.1065	2,130
69	24.82	496,400	.6496	12,992	.1621	3,242
71	66.86	668,600	.5935	5,926	.1017	1,017
12	70.36	703,600	.9184	9,184	.1555	1,555
71s°	78.25	782,500	.4172	4,172	.0855	855
		574,400*		9,356		1,986

s—Subsoil. This group constitutes 6% of total.

*—1,000,000 lbs. per acre 6 $\frac{2}{3}$ ms.

°—Acid condition.

Plate I

*Relation of Nitrogen to Crop
Yield*

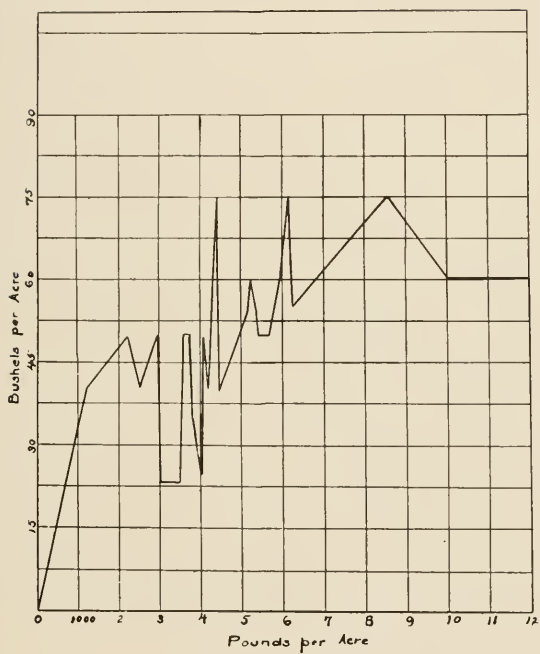


Plate II

Relation of Phosphorus to Crop
Yield



Plate III

Relation of Organic Matter to Yield

