SOIL SCIENCE

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Some Characteristics of Purdue Soil Testing Data From Field Plots[1]

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The objective of this research was to study changes in Purdue soil testing data related to liming and fertilization. Barber and Stivers (1) have reported that increases in phosphate soil test level as a result of phosphate fertilization are related to the initial soil test level of phosphate. These increases, however, may be masked due to variation involved in the two separate samplings (before and after) being compared. It was thought that, by using small plots and doing a thorough job of sampling, an accurate measure of the increase could be obtained. Barber (2) also studied the relation of different potash soil test levels to cropping, but he did not report clearly both his beginning and ending levels.

Methods and Procedure

One composite soil sample from each field plot of several fertilizer experiments was taken in late spring, prior to the initiation of each experiment. Other composite samples were taken from the same plots each year thereafter, that the experiment was continued. These soil samples were taken just before fertilizer was applied and before corn or soybeans were planted in the spring.

Composite samples consisted of 15 or more Hoffer tube cores per plot, taken in the harvest area to a 7 inch depth. In 1962, these cores were hand mixed, and a pint was taken for the tests. In the following two years the composite sample was not hand mixed and subsampled prior to submission for the tests. Rather, the whole of the 15 or more cores was submitted for the tests.

Soil tests on all samples were conducted by the Purdue Soil Testing Laboratory using the procedures of Spain and White (4, 5).

Results and Discussion

The initial soil sample data taken just prior to the initiation of fertilizer research at five locations are summarized in Table 1. At all locations phosphate soil test data were most variable as shown by the coefficient of variation. Potash soil test data were nearly as variable. Inasmuch as these fields had been selected for uniformity, it was dif-

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TABLE 1

Characteristics of portions of Indiana farm fields as described by Purdue soil testing data prior to the initiation of fertilizer experiments.

Soil type or types	Area acres	Location	Year sampled	Purdue soil test	No. of plots in sample	Sample means	Standard Error of individuals	Coefficient of variation	Range
Runnymede 1.	1.19	Porter	1962	pH	45	6.17	0.114	1.84%	6.0- 6.4
				P_2O_5 Lbs./A.	45	227	44.8	19.7	127 -292
				K_2O_5 Lbs./A.	45	183	23.8	13.0	151 -250
				Color	45	23.0	0.0	0.0	0
				Texture	45	4.00	0.0	0.0	0
Blount sil.	1.73	Randolph	1962	pH	66	6.72	0.173	2.58%	6.2- 7.0
				P_2O_5 Lbs./A.	66	114	47.7	41.8	46 -271
				K_2O, Lbs./A.	66	185	44.8	24.2	133 -349
				Color	66	74.0	0.0	0.0	0
				Texture	66	4.00	0.0	0.0	0
Russell sil. Reps. II & III	117	Tippecanoe	1963	pH	84	5.56	0.458	8.18%	5.0- 6.7
Fincastle sil. Rep. I	0.58			P_2O_5 Lbs./A.	84	40.2	12.7	31.8	19 - 89
				K_2O, Lbs./A.	84	128	25.2	19.7	79 -220
				Color	84	75.2	0.72	0.96	74 - 76
				Texture	84	4.00	0.0	0.0	0
Crosby sil.	2.09	Tippecanoe	1963	pH	85	5.69	0.279	4.90%	5.1- 6.4
				P_2O_5 Lbs./A.	85	27.9	18.6	66.7	9 -126
				K_2O, Lbs./A.	85	102	27.1	26.6	58 -140
				Color	85	74.5	3.09	4.15	64 -85
				Texture	85	4.00	0.00	0.0	0
Martinsville sil. (2 Exp.)	2.38	Tippecanoe	1964	pH	114	6.56	0.219	3.34%	5.8- 7.1
Russell sil. (1 Expt.)				P_2O_5 Lbs./A.	114	76.5	73.5	96.1	34 -800
				K_2O, Lbs./A.	114	173	73.3	42.4	101 -720
				Color	114	75.0	0.00	0.0	0
				Texture	114	4.00	0.00	0.0	0

TABLE 2
Relation of Purdue phosphate soil test levels to phosphate fertilization on two Indiana soils

Soil	Crop	Experiment	No. of plots in ave.	1962 Level Lbs./A. of P_2O_5 soil test	1962 Lbs./A. of P_2O_5 applied as fertilizer	1963 Level Lbs./A. of P_2O_5 soil test	1963 Lbs./A. of P_2O_5 applied as fertilizer	1964 Level Lbs./A. of P_2O_5 soil test	Build-up of Phosphate in Lbs./A. of of P_2O_5 per 100 Lbs./A. of P_2O_5 applied in fertilizer: These Exp'ts.	Build-up …: Barber's Exp'ts.
Blount sil	Soybeans	Phosphate	3	134	0	141	0	154	—	—
	"	"	3	155	30	171	30	176	35	95
	"	"	3	142	60	136	60	168	22	92
	Average			144	—	150	—	166	—	—
	LSD — 5%			N.S.		N.S.		N.S.	-------	-------
	No significant difference when all years were combined									
Blount sil	Corn	Phosphate	3	104	0	101	0	110	—	—
	"	"	3	111	28	112	28	137	46	79
	"	"	3	98	78	143	78	151	34	73
	"	"	3	98	128	123	128	192	37	73
	Average			103	—	120	—	147	—	—
	LSD — 5%			N.S.		N.S.		N.S.	-------	-------
	LSD — 5%	among years 41 Lbs./A. of P_2O_5 soil test.								
	LSD — 1%	among years 25 Lbs./A. of P_2O_5 soil test.								
Crosby sil.	Corn	Phosphate	6	—	—	24	0	33	—	—
	"	"	6	—	—	16	150	94	52	13
	"	"	6	—	—	38	300	178	47	30

TABLE 3

Relation of Purdue Potash Soil Test Levels to Potash Fertilization on Three Indiana Soils

Soil	Crop	Experiment	No. of plots in ave.	1962 Level Lbs./A. of K_2O soil test	1962 Lbs./A. of K_2O applied as fertilizer	1963 Level Lbs./A. of K_2O soil test	1963 Lbs./A. of K_2O applied as fertilizer	1964 Level Lbs./A. K_2O soil test	Change in level of K_2O soil test in percent
Blount sil.	Soybeans	Potash	3	187	0	184	0	191	+ 2.1
	"	"	3	194	30	191	30	189	— 2.6
	"	"	3	191	60	182	60	187	— 2.1
	"	" Average		191	—	186	—	189	— 1.0
Blount sil.	Corn	Potash	3	149	0	181	0	195	+ 23.6
	"	"	3	173	40	180	40	195	+ 12.7
	"	"	3	155	80	196	80	215	+ 38.7
	"	"	3	182	120	229	120	236	+ 29.7
	"	" Average		165	—	197	—	210	
		LSD — 5%		N.S.		15		N.S.	
		LSD — 1%		N.S.		22		N.S.	
There is no significant difference among years.									
Runnymede l.	Soybeans	Potash	3	169	0	120	—	—	— 29.0
	"	"	3	174	20	111	—	—	— 36.2
	"	"	3	164	40	121	—	—	— 26.2
	"	" Average		169		117			
		LSD — 5%		N.S.		N.S.			
There is no significant difference among years.									
Runnymede l.	Corn	Potash	3	169	0	143	0	170	+ 0.6
	"	"	3	179	40	145	40	187	+ 4.5
	"	"	3	183	80	155	80	207	+ 13.1
	"	"	3	204	120	147	120	221	+ 8.3
		Average		184		147		195	
		LSD — 5%		N.S.		N.S.		N.S.	
		LSD — 5% among years was 33 Lbs./A.							
Crosby sil.	Corn	Potash	3	—	—	100	0	133	+ 33.0
	"	"	3	—	—	110	180	183	+ 66.4
	"	"	3	—	—	105	360	270	+157.1

ficult to see how so much variation could exist. Even though uniformly cropped the previous few years, these fields apparently had not been uniformly fertilized. Variation in fertilization may have occurred some years previously due to stopping a fertilizer spreader, pasturing livestock, locating strawstacks on the area, locating building on or near the experimental area, or cropping differently many years ago.

On the Martinsville and Russell soil locations very high phosphate and potash soil test values were located along the south edge of the experimental area, possibly where a lane used by livestock had been at one time.

Soil pH varied relatively less from plot to plot than the phosphate and potash soil testing data. However, the range in soil pH values was greater than expected in three of the five locations. On the Russell and Fincastle soils location, proximity to a gravel road resulted in a higher pH level in the replication nearest this road.

Soil color and texture varied less than all other soil testing data.

Changes in phosphate soil test levels are a result of phosphate fertilization are given in Table 2. There was a trend toward higher levels in soil phosphate on those treatments receiving the higher rates of phosphate fertilizer. On the Blount soil this trend did not result in significantly higher phosphate soil test levels on either the corn or the soybeans experiments. There was some indication of increasing phosphate soil test levels on the Blount soil even where no phosphate fertilizer had been applied.

Changes in potash soil test levels as a result of potash fertilization are given in Table 3. There was a trend toward higher soil test levels of potash on the Blount and Crosby soils where several rates of potash fertilizer were applied for corn. However, on the Blount soil used for corn, there was a 23.6 percent increase in soil test level from 1962 to 1964, even though no potash had been applied. One hypothesis is that high rates of nitrogen and phosphate fertilizer (which were used on all rates of potash plots) stimulated soil microbial action so that previously unavailable soil potash became available. However, if this were true it is believed that it should also have happened on the Runnymede loam with corn.

There was a large decline from 1962 to 1963 in potash soil test levels in the potash experiment with corn on Runnymede loam. This decline of 37 Lbs. per A. was significant at the 5 percent level of probability. No good reasons for this decline are known. It is possible, although not thought to be probable, that the 1963 decline in potash soil test levels was related to soil moisture content at the time of sampling. This decline can not logically be ascribed to errors in testing procedure because at least one standard soil is tested with each tray of samples. Furthermore, Golke and Baumgardner (3) conducted experiments in which they retested the same soil samples. Twenty Lbs. per A. of potash was the biggest difference reported among triplicate samples.

Liming two different soils, the Crosby and the Runnymede, at rate of 2 or 2¼ T. per A. resulted in an increase of 0.1 to 0.15 pH unit in one year. However, on the other soils where no lime was applied, pH changes were about the same in magnitude, although sometimes they decreased. In several experiments soil pH levels did not change in the two year period.

Soil color and texture of the same field plots varied little or none from year to year.

Summary

Composite plow layer soil samples were obtained from the same field plots for two or three consecutive years. These samples were tested routinely in the Purdue Soil Testing Laboratory. These initial soil samples from small plots in relatively small areas of farmers' fields, showed great variation in phosphate and potash soil test values. Soil pH varied less and soil color and texture varied little or none at all.

Increasing rates of phosphate fertilization tended to result in increasing soil test levels of phosphate. The build-up or increase of phosphate soil test levels was, in general, less than that reported by Barber.

Samples taken both years following the initial application of increasing rates of potash fertilizer showed differing changes in potash soil test levels. It was impossible to logically explain the large decrease in potash level which occurred on the Runnymede loam the first year following potash fertilizer application.

Changes in soil pH values were small even after 2 T. per A. of agricultural limestone had been applied. Soil color and texture changed very little or none at all.

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