INFLUENCE OF FERTILIZERS UPON THE REACTION OF SOILS

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The crop-producing capacity of agricultural lands in Illinois tends to decrease as the acidity of these soils becomes greater. When accompanied by a low level of production, the acid condition of soils presents a more or less serious economic aspect which requires careful consideration. Large sums of money are expended annually in an effort to overcome soil acidity and the many ills which usually accompany it.

The dropping off in crop returns from farm lands naturally leads to the use of various fertilizers in an effort to keep up the fertility and maintain a relative high level of production. Some fertilizers and fertilizing materials are used with a view of correcting acidity and ameliorating the physical condition of soils, whereas others are used to supply certain plant food elements which may be deficient or not readily available in the soils in question.

Some fertilizers tend to increase the acidity of soils upon which they are used, whereas others act in a reverse manner. Ammonium sulphate, when used in the usual quantities and for a sufficiently long period of time, will increase soil acidity, and sodium nitrate will, under like conditions, increase the alkalinity of soils. Superphosphate 16 per cent grade in a suspension has a pH varying from 3.0 to 5.6, and this material has a slight tendency to increase soil acidity. Rock phosphate in suspension has a pH of approximately 6.4 and has a slight tendency to decrease soil acidity. Fertilizers such as the above named phosphates are used in relatively small quantities in comparison to the volume of soil to which they are applied, so that their effect on soil reaction is not apparent because, usually, there is not enough of the reacting material to overcome the strong buffer action of the soil.

The experimental work here reported consisted of determining the hydrogen ion concentration of the soils from experimental field plots which had been subject to various forms of fertilization for a number of years. The samples of soil upon which the determinations were

made represented the top soil to a depth of approximately seven inches. The pH determinations were made electrometrically, using the quinhydrone electrode.

Table I shows that the only material which made any considerable change in the soil reaction in the Hartsburg field, representing a very fertile soil, was lime treatment which raised the pH from about 6.10 to nearly 7.00, or the neutral point. On this field, manure, residues, rock phosphate, and kainit apparently had no influence on the reaction of the soil.

In the Toledo and Ewing fields (Table I), representing some of the less productive soils, rock phosphate tended to raise the pH. In the four comparisons of these two fields, three showed a slight increase in pH where rock phosphate was used. The use of lime on these two fields was the big factor in bringing the pH up to near the neutral point. Manure, residues, and kainit had no considerable influence on the soil reaction in these tests.

TABLE I.

HYDROGEN ION CONCENTRATION OF SOILS FROM FERTILIZED EXPERIMENTAL FIELD PLOTS

Plot No.	Fertilizer Treatment	Hartsburg Field pH	Toledo Field pH	Ewing Field pH
1.	None	6.10	5.17	5.00
2.	Manure	6.10	5.10	4.83
3.	Manure—Lime	7.03	6.35	7.10
4.	M. L. Rock Phosphate	6.94	6.60	7.28
5.	None	6.18	5.10	5.00
6.	Residue	6.18	5.10	5.10
7.	R. Lime	6.94	6.35	6.86
8.	R. L. Rock Phosphate	6.94	6.35	7.37
9.	R. L. P. Kainit	6.94	6.44	7.37
10.	None	6.42	5.25	5.00

Table II shows comparisons of the effect of rock phosphate and superphosphate when used with a light and a heavy application of lime on the Odin field. On Plot 603, where two tons of lime were used, superphosphate showed a slight tendency toward a more acid condition, whereas the rock phosphate showed a slight tendency toward alkalinity. The margins were very small in both cases. The influence of the rock phosphate on Plot 604 might also be discounted because the subsoil on this plot had a slightly higher pH (less acid) than the surface soil or the subsoils of the other plots in this comparison.

On Plot 803 Table II, where a relatively large quantity of lime was used (eight tons an acre) superphosphate showed no tendency to increase the acidity. The rise in pH on Plot 804 due to the use of rock phosphate showed a very slight tendency to increase the alkalinity of the soil.

In the Odin field experiment (Table II), relatively large quantities of both phosphates were used. In a period of years from 1905 to 1919, a total of fourteen tons an acre of rock phosphate was applied to the land, and during the same period, seven tons an acre of superphosphate were put out. The quantities of the materials used were sufficiently large to show their possibilities in influencing the reaction of the soil.

TABLE II

HYDROGEN ION CONCENTRATION OF SOILS FROM FERTILIZED PLOTS ON THE ODIN EXPERIMENT FIELD

Plot	Fertilizer treatment	pH
2 tons of lime		
602	Lime Kainit	6.01
603	Lime Kainit superphosphate	5.84
604	Lime Kainit rock phosphate	6.18
8 tons of lime		
802	Lime Kainit	7.11
803	Lime Kainit superphosphate	7.11
804	Lime Kainit rock phosphate	7.20