EFFECT OF CERTAIN FERTILIZER AND LIME TREATMENTS ON SOME CHEMICAL PROPERTIES OF CECIL SANDY LOAM

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The Virginia Agricultural Experiment Station has conducted a field experiment at Chatham, Va., since 1924 to determine the effects of several fertilizer treatments, both with and without lime, on the yields of corn, wheat, and red clover hay in a rotation. Data reporting the progress of this experiment and information on the complete yield data are presented in the annual reports of the Pittsylvania County branch of the Virginia Agricultural Experiment Station.

The purpose of the study reported here is to determine the extent and nature of some of the chemical properties of the soil resulting from the different lime and fertilizer treatments on the 18-year-old rotation plots of corn, wheat, and red clover hay at the Pittsylvania County Agricultural Experiment Substation at Chatham, Va.

MATERIALS AND METHODS OF PROCEDURE

DESCRIPTION OF PLOTS

The experiment was originally started and conducted for 12 years as a 4-year rotation of corn, wheat, and red clover hay for 2 consecutive years. However, due to the poor results obtained from the second year of hay, the rotation was changed in 1935 to a 3-year rotation of corn, wheat, and red clover hay.

Three 1-acre adjoining fields were used for the three crops in the rotation. Each field was divided into six plots. The fertilizer treatments are given in Table 1. One-half of each plot was limed at the rate of 2 tons of ground limestone per acre at the beginning of the experiment, and thereafter at the rate of 2 tons of ground limestone per acre once in the 4-year rotation. When the 3-year rotation was started, ground limestone was applied at the rate of 1 ton per acre once during the rotation. The other half of each plot was unlimed. Each subplot was 1/12 acre in size.

This test was conducted on an area of soil mapped as Cecil sandy loam, a soil developed from residual material weathered from granite and other light-colored acidic rocks. The variability of the texture of samples taken indicates that erosion has removed a considerable part of the surface soil from some of the plots, resulting in a soil of heavier texture than a sandy loam.

SOIL SAMPLING

Composite samples were taken from each sub-plot in September 1941, each sub-plot being sampled from six separate areas. The samples were prepared for analysis in the usual manner by being air-dried and screened through a 20-mm sieve.

METHODS OF ANALYSIS

Exchangeable hydrogen was determined by a modification of Parker's method (12). Two hundred fifty cc of normal neutral barium acetate was leached through 10 grams of soil held in a Gooch crucible. Instead of titrating the leachate electrolytically to a pH of 7.0, the total leachate which consisted of a volume of normal neutral barium equal to that of the leachate, were titrated to the end point of phenolphthalein with 0.1 normal sodium hydroxide. Exchangeable hydrogen was calculated from the difference in titration values.

Exchangeable calcium, magnesium, and potassium were removed from the soil by leaching with normal ammonium acetate. A sample consisting of 25 grams of soil was leached with 500 cc of solution. After making the solution to a volume of 500 cc, exchangeable calcium and magnesium were determined from a 200-cc aliquot representing 200 grams of soil, and exchangeable potassium was determined from a 300-cc aliquot representing 300 grams of soil.

The aliquots were evaporated to dryness and organic matter was destroyed by the addition of hydrogen peroxide. The aliquots were titrated against 0.05 normal potassium permanganate, as outlined by Hillebrand and Lott. Excess ammonium salts were removed from the remaining from the calcium determination by evaporation and treatment with concentrated nitric acid. Magnesium was precipitated as magnesium ammonium phosphate and determined volumetrically according to Wright (20).

Potassium was precipitated as potassium sodium cobaltinitrate and determined by titration with 0.05 normal potassium permanganate according to the method outlined by Wilcox (27).

The total cation exchange capacity was determined from the quantity of ammonium absorbed by the soil when leached with normal neutral ammonium acetate to replace exchangeable calcium, magnesium, and potassium. The following modification of the method of Chapman and Kelly (4) was used. After removal of the occluded ammonium acetate on the soil sample by washing with alcohol, the ammonium remaining in the leachate was determined by distillation.

Organic matter was determined by the wet method of Plice and Lunin (13). Total nitrogen was determined by the Gunning Hubbard method (1). All determinations were run in duplicate. When close agreement was found between the two determinations, the analysis was repeated. Each value reported in Table 1 is an average of three values, each representing duplicate determination of the three sub-plots receiving the same treatment during the course of the experiment.

MATHEMATICAL AND STATISTICAL ANALYSIS OF THE DATA

Exchangeable hydrogen, calcium, magnesium, and potassium, organic matter, and total cation exchange capacity were statistically analyzed by the method of Chapman and Kelsey (4). All 36 values for each soil property were used for calculus analysis, instead of the average values as in Table 1. The three separate fields used in the experiment were treated as replicates. There may be some objection to the statistical analysis of a systematically arranged such as this one, but it is thought that the statistical treatment enabled a more complete interpretation of the data.

Coefficient of correlation was determined by the method outlined by Snedecor (21). Percentage base saturation was statistically analyzed by the method of analysis of variance outlined by Snedecor (21).