Tracing the Calcium, Phosphorus, and Iron from a Limed and Unlimed Lateritic Soil to the Grass and to the Animal Blood

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DATA are presented on the effect of lime application on the percentage composition of available calcium, phosphorus, iron, magnesium, and manganese in a lateritic soil from Puerto Rico, and on the percentage composition of these total minerals in the grass growing in this soil. Data are also presented on the effect of the unlimed and limed grass on the calcium and inorganic phosphorus in the blood serum and on the iron and hemoglobin in the blood of female goats.

EXPERIMENTAL PROCEDURE

Eighteen plots, each with an area of 0.4 acre, were selected in a field of “Fajardo clay” at the Experiment Station farm in Rio Piedras, Puerto Rico. Fajardo clay is a lateritic soil of the humid region of Puerto Rico, acid in reaction, with a level or gently sloping relief, derived from old, high alluvial material and iron outwash fans of adjacent shale hills. Half of the randomized plots were limed to pH 6.5. The amount of limestone varied from 8 to 10 tons per acre.

The field was planted in the middle of July 1943 with a mixture of Para grass, Panicum purpurascens, and Carib grass; Eriochloa polystachya, the former known as “Malojillo” and the latter as “Malojilla”, two valuable pasture and soilage grasses in the humid lowlands of Puerto Rico.

Five consecutive grass crops were harvested up to October 1945, of which the third and fifth were fertilized with ammonium sulfate at the rate of 500 pounds per acre.

Ten virgin female goats were randomized in their pens and given the parasite treatment of 12 grams of phenothiazine per os. The goat experiment was divided into three periods, as follows: Pre-feeding, October 19 to November 14, 1944; pre-gestation, November 15, 1944, to January 15, 1945; gestation, January 16 to July 15, 1945.

Separate composites of the unlimed and limed grass were cut daily in strips from each corresponding plot and ground. Eight pounds of the chopped unlimed and limed grass were fed, respectively, to each of the corresponding group of five goats. The feeding box in each pen avoided the contamination of the grass with urine and excrement. The amount of residual grass left daily by each animal was also weighed. A composite sample from the grass was taken daily for moisture analysis. A record was therefore kept of the amount of green of the pre-gestation period, and thereafter, every middle of the month. About 10 ml of blood were drawn from each animal by a direct puncture of the jugular vein, 2 ml for the hematological test and 8 ml for the chemical test. The blood was used for the red blood cell and white blood cell counts. A 0.7-ml portion of this blood was used for hemoglobin, 0.1 ml of oxalated blood was centrifuged immediately after drawing, 12.5 grams of air-dried soil and 25 ml of extracting solution were placed in a test-tube, 6 inches long and 1 inch in diameter, and the tube stoppered and shaken horizontally for 2 minutes in a reciprocating shaker at a speed of about 120 cycles per minute.

Available phosphorus and iron were determined with a Klett-Summerson photometer, the former as phosphorus in a Coleman spectrophotometer was used to read the transmittances corresponding to the colored solutions of iron. Available phosphorus and iron were determined with a Klett-Summerson photometer, the former as phosphorus in a Coleman spectrophotometer was used to read the transmittances corresponding to the colored solutions of iron.

Blood.—Blood samples were taken from each goat at the beginning of the pre-feeding period, 1 month after the beginning of the pre-gestation period, and thereafter, every middle of the month. About 10 ml of blood were drawn from each animal by a direct puncture of the jugular vein, 2 ml for the hematological test and 8 ml for the chemical test. A 0.7-ml portion of this blood was used for hemoglobin, 0.1 ml of oxalated blood was centrifuged immediately after drawing, and the tube stoppered and shaken horizontally for 2 minutes in a reciprocating shaker at a speed of about 120 cycles per minute.

Chemical test.—Iron was determined in a 0.5 ml of nonoxalated blood by the Wong’s (8) modified method. The nonoxalated blood was centrifuged immediately after drawing for 5 minutes at 2,800 r.p.m. in an inverting clinical centrifuge. This was found necessary, to analysis, since the red blood cells of goat’s blood are often being drawn for 5 minutes at 2,800 r.p.m. in an inverting clinical centrifuge. This was found necessary, to analysis, since the red blood cells of goat’s blood are often

METHODS OF ANALYSIS

Soils.—Three composite samples of the soil were taken from each plot, the first previous to the lime application; the second and third, 15 and 23 months, respectively, after the lime application. Each soil sample was analyzed for exchangeable calcium, magnesium, and manganese and for available phosphorus and iron. The pH values were determined.

Exchangeable bases were run by Peche’s (5) method of extracting with N neutral ammonium acetate solution. The Coleman spectrophotometer was used to read the transmittances corresponding to the colored solutions of iron and manganese.

The so-called available phosphorus and iron were extracted with Morgan’s extracting solution of sodium acetate buffer at pH 4.8 with acetic acid and were placed in a test-tube, 6 inches long and 1 inch in diameter, and the tube stoppered and shaken horizontally for 2 minutes in a reciprocating shaker at a speed of about 120 cycles per minute.

Available phosphorus and iron were determined with a Coleman spectrophotometer, the former as phosphorus in a Coleman spectrophotometer was used to read the transmittances corresponding to the colored solutions of iron.

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