BASE EXCHANGE DIFFERENCES IN OLD-GROWTH FOREST AND ADJACEI CULTIVATED SOILS

by
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According to most recent estimates there are in the States of Illinois, Indiana, Missouri and Ohio 9,300,395 acres of abandoned land. (2)Altogether there is a vast area of marginal land in the Central States where replanting to forest species may be necessary—a total for the above named states and Iowa of 17,000,000 acres. (2)This great area, much of it exhausted by cultivation and erosion losses, presents many problems from the standpoint of reforestation. The accumulation of organic matter is gone from the surface horizon, in fact on much of the land the A horizon itself has been extensively eroded away. The porosity of the surface horizon, developed under forest cover, has been destroyed. The silty upper horizon, gone or rendered much heavier by admixture with clay from below, cracks and bakes in hot weather and conditions are not favorable for germination and survival of hardwood species. So profound has been the change in the soil following deforestation that difficulty has been experienced in establishing growth of the hardwood species which originally grew on the land.

With a view to increasing our knowledge or the changes undergone in the soils formerly in forest the following series of experiments were undertaken. Since loss of exchange calcium and magnesium is often a good criterion of fertility losses and, taken in its relationship to the successive soil horizons, gives a perspective of the soil history, a study of exchangeable calcium and magnesium was chosen as a beginning.

Seventeen old-growth woods and adjacent cultivated sites were located: 9 in Ohio, 3 in Indiana, 1 in Michigan, and 4 in Illinois. Conditions as near virgin as possible were secured, based on absence of grazing, cutting and fire. On the sites selected there had been no cutting except the removal of an occasional tree, no apparent evidence of fire and no disturbance of soil by tramping. The woods selected were found on widely differing soil conditions: lacustrine; glaciated (Wisconsin and Illinoian), unglaciated; swamp forest, steep forest; low organic matter soils, young soils, old soils, sandy soils, and clay soils. The forest types represented were elm-ash-maple, white pine, oak-chestnut, oak-hickory, and beech-maple.

The wooded and cultivated areas were as closely adjacent as possible, usually just over a fence, and care was exercised in sampling on the same elevation in order to avoid any local variations in soil type. The entire organic humus or H horizon. Incorporation matter is rapid.

Mineral soil samples were taken in the 0-4 inches in the woods and 0-6 in the fi horizon was taken at about 8-12 inches d woods and field. This depth of sampling varie with the site but generally this 8-12 inch de low the organic A_1 horizon in the woods, bel sole in the fields and above the B horizon i

In the laboratory the samples were e percolation with neutral normal ammonium cording to the method of Schollenberger an (3) and hydrogen, calcium, and magnesium on the percolate. One hundred thirty six ca minations and the same number of magne minations were made. The oven-dry basis appl out.

Some clear differences stand out in the

1. There has been a great loss of magnesium from the A_1 horizon of forest so cultivation. This loss is due not wholly to to surface erosion also.

2. There is an indication that the magnesium content of the A_2 horizon in the greater than it is in the forest soil. This ma by the bases being absorbed in the lower hor are liberated by cultivation and leached dow storage is probably a fortunate one for su forestation. The tree roots can more easily replaced calcium and return it to the surf the litter where it will hasten the developme ous structure in the A_1 horizon.

3. Great variation in amounts of repl cium and magnesium occurs in litter of the types on widely different soil types. For Ohio on a white pine site mixed with some growing on a shallow, highly siliceous soi from Pottsville Conglomerate, there were 1 valents of calcium per 100 grams in the lit m.e. per 100 grams in the A_1 horizon. Ma curred to the extent of 3.1 m.e.'s in the lit m.e.'s in the A_1 horizon of the same wood pure white pine stand in northern Illinois Yellow Silt Loam weathered from limeston lying St. Peter's sandstone, the litter show calcium, and the A_1 6.4 m.es. The magnesi as 15.4 and 2.1 m.es. for the litter and A_1