AVAILABILITY AND FIXATION OF PHOSPHORUS IN HAWAIIAN SOILS

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The soils of the Hawaiian Islands have been formed largely through the laterization of volcanic materials. Most of the soils, especially those of the higher altitudes, are of a reddish or reddish yellow color. Some of the lower lying lands and those of a more level topography of higher altitudes or those which have been at one time rather poorly drained are of a darker color and usually contain more organic matter than the red or yellow soils. Most of the red or yellow soils may be classed as laterites or lateritic soils and have a high sesquioxide-silica ratio. Much of the iron and aluminum exist in these soils in amorphous or colloidal forms as the oxides with varying degrees of hydration, and not as crystalline primary minerals as is generally true in most glacial or alluvial soils.

McGeorge (13, 14, 15) has made rather extensive studies of phosphorus in these soils. As a rule he found their phosphorus content well above that for mainland soils, and yet it many of these laterites there is a deficiency of quickly available phosphorus. He found that the makai (lowlands) lands were usually higher in total and citric-soluble phosphorus than the mauka (highlands) lands. He also reported that low pH values in soils were usually correlated with low availability of native soil phosphorus and seemed to think that lands with less than 40 p.p.m. of citric-soluble phosphoric acid (P₂O₅) might respond to phosphate fertilization. However, little response has been obtained from phosphate fertilization in field tests on these soils even when they were known to be low in available phosphorus.

Recent articles by Hance (7), Ayres (1), and Davis (4) deal with phosphate fixation in Hawaiian soils. Although Ayres has taken water-insoluble phosphorus to mean fixed phosphorus, which may not always mean that the phosphorus is fixed in slowly available forms, his work does indicate that soils in certain districts have a much greater capacity for fixing phosphorus than those in other districts, and that most Hawaiian soils fix large quantities of phosphorus.

EXPERIMENTAL

Beginning in 1930, the writer has made a collection of 100 samples of Hawaiian soils and has used them for phosphorus availability and fixation studies. Since there seems to be a relation between the base saturation and both availability and the fixation of phosphorus in slowly available forms, the pH values were included in this work. The pH values were determined by the colorimetric method known

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3 Figures in parenthesis refer to "Literature Cited," p. 884.