THE BIOLOGICAL EFFECT OF AVAILABLE PHOSPHORUS IN HAWAIIAN SOILS

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PHOSPHORUS is not only a very important plant food, but it is also one of the outstanding factors affecting the rate of biological activity in the soil. Phosphorus has usually been considered an aid to nitrification, but the effect of phosphorus on this process may be reversed by increasing the amount of available carbonaceous energy material in the soil. In this case the phosphorus also stimulates biological action, but with an entirely different set of organisms and with an entirely different effect. This increased biological action results in a more rapid utilization of mineral nitrogen by the soil microorganisms, and a more complete change of this nitrogen into organic form in the micro-organic tissue. From a practical point of view, this action of the phosphorus is distinctly beneficial in at least three ways, viz., (a) the leaching of inorganic nitrogen by irrigation water is greatly reduced because of the reduction of inorganic nitrogen, (b) the availability of the nitrogen is better distributed throughout the growing season, and (c) the amount of phosphorus in the organic or biological balance is greatly increased.

EXPERIMENTAL

In June 1930, a set of plats was laid out at the Waipio Substation of the Experiment Station, Hawaiian Sugar Planters' Association, in which sodium nitrate was used in combination with molasses and with molasses and rock phosphate in the fertilization of cane. During the latter part of June, 1930, the fertilizers were applied in the line (row), the cane planted, and irrigation water applied in the normal manner. The three plats used in this connection were fertilized before planting as follows:

Plat 2. Sodium nitrate, 1,500 pounds an acre.
Plat 4. Sodium nitrate, 1,500 pounds an acre.
   Waste molasses, 10 tons an acre.
Plat 15. Sodium nitrate, 1,500 pounds an acre.
   Waste molasses, 10 ton an acre.
   Rock phosphate, 6 tons an acre.

On September 29, and again on November 5, 1930, these plats were sampled by 12-inch depths to a total depth of 6 feet and the nitrate nitrogen determined. The results are given in Tables 1 and 2.

Nitrate nitrogen is soluble in water and remains so in the soil solution. Under irrigation the nitrate moves with the irrigation water. The downward movement, however, is usually greater than the return, with the net result that under irrigation nitrate nitrogen tends

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