Some Aspects of Soils and Soil Survey on the Island of Maui, Hawaii

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Introduction

The Island of Maui is located near the eastern end of the Hawaiian Archipeligo. It is approximately 2,000 miles south of Alaska and 2,400 miles southwest of California.

Maui, like all the Hawaiian Islands, is of volcanic origin, and is mountainous. It has a low proportion of potentially arable land, and the arable areas are used very intensively. This has resulted in a highly specialized type of agriculture.

Maui is located on the north edge of the tropics, but is protected from summer temperature extremes by its position astride the trade wind belt (1). In addition to moderating the temperature, the trade winds also set the major rainfall pattern for Maui. Rainfall is characteristically high on the windward slopes and mountain peaks, but very low on the lower leeward slopes. Annual rainfall of over 350 inches has been recorded at Puu Kukuii on the West Maui peaks while long time average annual rainfall at Olowalu on the leeward coast is 15 inches.

Agriculture

Agricultural enterprises on leeward West Maui consist of one sugar cane plantation and one pineapple plantation. They presently have about 20,000 acres in these crops. Sugar cane grows best with maximum sunlight and large amounts of water. Pineapple also requires maximum sunlight but has a much lower water requirement than sugar cane. On leeward West Maui, sunshine is at a maximum along the coast but decreases drastically with rise in elevation toward the usually cloud-covered mountain peaks. Rainfall is very low along the coast but increases rapidly at high elevations. The agricultural land of leeward West Maui is confined to the rather dry, sunny, lower slopes. Higher slopes are not suited to sugar cane and pineapple production because of steepness and/or narrowness of the land surfaces between the gulches.

Except for one experimental field, all the sugar cane seen was irrigated. Water to irrigate the cane is collected from the high rainfall windward slopes and delivered to the production area through a complicated series of tunnels, ditches, and flumes. Irrigation engineers have their systems designed to apply approximately nine-acre-inches of water every two weeks.

Pineapple grows best in the 25 to 60 inch rainfall areas of West Maui. With rainfall less than 25 inches the plants show moisture stress and the fruit is reduced in size. None of the pineapple fields were irrigated. In rainfall above 60 inches disease becomes the limiting factor. Pineapple producers have rain gauges in many of their fields to compile rainfall data for use in correlating production problems and yields with production sites.

Soil Classification and Survey

Soils mapped during the survey of pineapple land of West Maui are currently classed as Low Humic Latosols, Humic Ferruginous Latosols, and Humic Latosols (1, 2). A predominant reddish-brown color, high clay content, relatively high organic matter content, high infiltration and percolation rates, and strong resistance to shear, are characteristics shared by soils in these three great soils groups.

Determining the actual proportions of clay in these soils is very difficult. (Clay as used here refers to very fine mineral particles). In the laboratory it is almost impossible to get soil samples completely mixed with water and dispersed so that the clay can be accurately measured. As a result many of the clay particles remain grouped together into small aggregates of silt size and are not measured as clay. Even so, the analyses give figures of 50 to 70 percent clay for many of these soils. This tendency of the clay particles to resist wetting and to remain grouped into silt size particles also makes it difficult for a soil scientist to determine the soil texture in the field. These tiny clumps of particles are still so durable even after continued wetting and hand rubbing that they give the soil a coarser feel and less stickiness and plasticity than laboratory data would indicate. The field soil scientist must then describe the apparent texture, based on wetting and hand manipulation of a soil sample and also the presumed texture, based on reference to soils with known composition.

The strong resistance to shear exhibits itself in banks and road cuts which stand vertically with minor slumping, sliding, or sloughing. This has a very practical importance to agriculture by imparting stability to the soil mass and thus preventing detachment of individual soil particles in the first stage of the soil erosion process. Resistance to shear becomes apparent indeed when one attempts to use a "sharpshooter" spade to dig a pit for field study.

Organic matter is relatively high in comparison with light colored soils of the midwestern United States. Moreover, it is distributed rather uniformly throughout the top 3 or 4 feet of the soil rather than being concentrated in the surface layer. Few Low Humic Latosols have less than 3 percent organic matter, while the figure may rise to 8 percent for Humic Latosols.

Infiltration and water percolation rates for these soils are apparently extremely high. While few data are available to bear this out, the very low volume of runoff during and after a heavy rain can be qualitatively measured by on-site observations. The small amount of rainfall which does run off is often clear, or nearly so, even in freshly tilled fields. Infiltration and percolation rates, 3 to 10 times the average rates of soils in the midwestern United States, seem probable.

Literature Cited

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