I. INTRODUCTION

(A) Soil Structure Conditions Affecting Plant Growth

The primary objects of any rational land usage consist in economic crop and stock raising and the application of soil conservation measures. The accomplishment of these objects is very closely dependent on a clear understanding of the soil and plant relationship.

Within the past three to four decades, this understanding has increased. Ecological investigations and soil surveys on the physical properties of the soil are continually revealing the true nature of this relationship.

The supply of water and mineral nutrients to a plant by the soil, is a factor of its root system and the available water and nutrients. The available water content of a soil may be limited by its capacity for storage or its ability to allow the water to percolate to deeper layers, away from the force of evaporation. A good structural condition ensures adequate supplies of air and moisture in the soil at one and the same time. A bad one, on the other hand, does not permit the co-existence of air and water in the correct relation required for plant growth. The results of several experiments have shown that some soils, although they are not highly productive, are not responsive to fertiliser dressings. In Uganda, for instance, (3) chemical analyses have shown no correlation between any nutrient factor and yield. It would appear that moisture and rootspread, both dependent on structure, are the limiting factors in crop production under Uganda conditions.

Adequate aeration seems essential for balanced crop growth as well as effective utilisation of plant minerals. The investigations of Allison,R.V. and Shive,J.W. (2), Knight,R.C. (27) and Henderson,L. (22) have demonstrated that increased root growth and activity take place when the air-supply is improved.

Defective aeration is a common feature of structureless clay soils such as are found in some Trinidad cacao areas. Hardy,F. (16) has suggested that maximum yields of cacao cannot be obtained under such conditions even when the nutrient deficiencies are remedied by manuring.

A badly aggregated soil offers mechanical resistance to root penetration. The plant's anchorage is weak. Its feeding roots cluster together in the sub-surface where aeration is adequate. This localisation of the root-system reduces the soil-volume on which the plant can draw for its moisture and nutrients.

Soil structure is very intimately connected with soil erosion. Rain falling on a crumbly soil, quickly penetrates into the deeper layers, and becomes available for plant use. In the case of a heavy structureless soil, there is very poor ingress for rainwater which soon saturates the surface soil and then runs down the slope. There is thus a loss of available water for plant use, loss of fine unaggregated soil particles owing to their greater mobility, loss of humus and soil minerals, all of which have to be made good by heavy manurial dressings and anti-erosion measures. Middleton (33) has employed the relation between soil aggregation and erosion in working out his dispersion ratios, which furnishes a useful erosional index.