

I. INTRODUCTION.

1. The Nature of the Problem.

The ability of soils to form crumbs under field conditions is of the utmost importance in agriculture since the water and air relationships of soils, and consequently crop production, are a direct result of this property. In this connection two features of soil crumbs are important viz., the extent to which soil crumbs can resist mechanical forces such as pressure and friction (i.e. crumb hardness), which govern the stability of crumbs to cultivation treatments and to the mechanical beating of rain, and the degree to which crumbs remain unchanged in the presence of excess water (aqueous stability). In such an excess of water soil crumbs **slake** to different degrees, giving rise to smaller water stable aggregates, prime particles, or both. The end point of this slaking has been termed the "ultimate natural structure" of the soil (13).

Where both these properties work adversely the permeability of the soil to water decreases and results in erosion. This is particularly the case in the United States of America and in Canada where continuous ploughing, the loss of humus and exchangeable calcium have produced erosion on an enormous scale. This has already thrown 11,000,000 acres out of cultivation (17). Owing to the rapid oxidation of humus, scanty cover and the terrific downpours, erosion also is a very real and menacing factor in tropical areas.

It is obvious therefore, that soil crumbs are of prime importance to plant growth and in soil conservation throughout the cultivated parts of the world. Yet data regarding these properties of the soil are very lacking, not because their significance is not realised, but because no suitable methods of measuring these properties are available.

It is therefore the object of this investigation to try to develop a method such that the measurement of these two major physical properties of soil crumbs can be made a routine laboratory analysis, and to see how the results obtained by such methods agree with the other properties of the soil, both physical and chemical.

Before proceeding to discuss methods of analysis, it is proposed to enumerate briefly the modern ideas concerning the nature of these soil crumbs and the factors influencing their properties, since what is hoped to be measured eventually will be the resultant effect of all these agencies.