STUDIES ON IMPROVEMENT OF SOME PHYSICAL & CHEMICAL PROPERTIES OF CALCAREOUS SOILS

By

IBRAHIM SOLIMAN ABU ZAYED
B.Sc. Agr. (Soils)
University of Ain Shams (1966)

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Name: Ibrahim Soliman Abu Zayed

Title: Studies on Improvement of Some Physical & Chemical Properties of Calcareous Soils.

This Thesis had been approved by:

1. [illegible]
2. A. Y. Elgala
3. [illegible]

Committee in Charge

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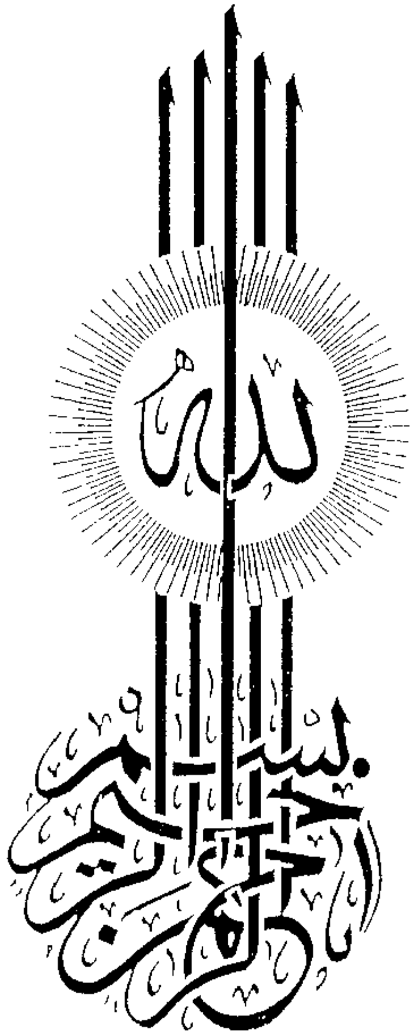
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I. INTRODUCTION

The increase in the population in Egypt was about 96% in the last 50 years, while the increase in the cultivated acreage for the same period was about 19%. To meet this situation two programs had to be implemented with a view to develop land fertility and productivity on the one land and at the same time expanding the cultivable area. The first part of this program is being achieved by the control and reclamation of soil salinity and alkalinity, and the development of soil fertility. The second part of the land development aimed at the expansion of the area under cultivation was started in 1953. Tahreer province is a pioneer project exemplifying the battle against the desert. This new province extends along the western edge of the Delta being bounded of the east by the Rosetta branch of the Nile and on the west by the western Desert.

The province is divided into two sections, the southern of which is mostly of sandy soil and depends for its irrigation on water from the Nile and under ground sources. The northern sector is mainly of loamy highly calcareous soils and depends entirely on the Nile water for irrigation.

Before putting this new land under cultivation a certain plan was made for its reclamation to improve its physical, chemical and biological properties. The productivity of such reclaimed land depends largely on the new properties which have been achieved through its reclamation.

Since growing alfalfa for a long period is a common practice for reclaiming the highly calcareous soils at the Northern Tahreer Province, it was thought of importance for this investigation to study the physical and chemical changes which took place at different periods.

2. REVIEW OF LITERATURE

The studies of several research workers which are pertinent to the changes of certain physical and chemical characteristics of calcareous soil caused by cultivation and the addition of organic residues especially those carried out on the highly calcareous soils of Egypt will be reviewed briefly under the following headings. Also, the effect of synthetic conditioners on certain properties of the soil will be also considered.

2.1- Characteristics of Calcareous Soils as Affected by Cultivation:

2.1.1- Physical properties:

2.1.1.1.- Particle size distribution:

It is common practice that cold diluted hydrochloric acid is used to remove calcium carbonate during pretreatment of soil samples for mechanical analysis (Diagnosis 1954) but such a practice is questionable for certain calcareous soils where the calcium carbonate is found not only as a cementing agent but also a distinct component of various particle size groups. This inherent particle size distribution has to be taken into account to obtain a true evaluation of the soil texture. Therefore, calcium carbonate particle size determination is very necessary, as these particles play an important role in the physical and chemical properties of soil. Salim and Massoud (1966) studies the calcium carbonate size distribution in the surface samples of the west Delta region and found that within the same textural class, the total calcium carbonate content may vary considerably and yet it may be the same for different textural classes. The same authors added that the highest percentage of calcium carbonate content is within the silt and clay fraction in the case of sandy clay loam soils and within the sand fraction in the sandy loam and sandy soils.

El-Abbaseri et al. (1971) studied the changes in a virgin land in the Nubaria region when cultivated for different period. They found that the fine fractions increased with increasing land use period, while the coarse fractions behave in an opposite way. The same authors reported that this change may be due to the increase in the finer fractions on account of the decrease of the coarser ones in the short run, and by disintegration of coarse fractions in the long run. They also found that fine fractions accumulate at the surface in the early stages then migrate down in the profile as the time progressed. In addition they stated that the relative amounts of each fraction in the surface layers are governed by the relative precipitation of either Nile mud or windborne sand, according to the profile situation in the general landscape area.

2.1.1.2- Bulk density and porosity:

Many investigators studied the soil porosity and its effect on water holding capacity and water movement. Baver (1956) stated that soil porosity affected water movement, and that the micro-pores are important in storage of soil water. Lyon and Buckman (1938) pointed out that organic matter played an important role in the formation of desirable soil structure by developing large aggregates, which increased the porosity and absorptive capacity. Lutz (1947) showed a highly significant correlation between the percentage of large pores in the soil and depth of water penetration. Kovda (1958) showed that alternate wetting and drying increased the porosity, Plyusnin (1960) and Baver (1961) indicated that the ideal soil is the one that has equal volume of large and small pores; such a soil would have sufficient aeration, permeability and water holding capacity.

Concerning the effect of organic matter on soil aggregation, Baver (1935) found positive correlation between the percentage of organic matter and the quantity of soil aggregates. Browning (1937) found that the addition of alfalfa green manure to different types of soils increased the large-size aggregates, infiltration and percolation of water. Childs (1940) noted that in calcareous soils, the presence of calcium carbonate helped the formation of stable aggregation. Musgrave et al. (1946) showed that micro-organisms and certain chemical substances increased the stability of soil structure to water drops, and soil aggregation influenced by organic matter and microbial activity. Browning and Milan (1949) reported that aggregates were significantly increased by increasing the units of organic matter. The authors added that the change in aggregation resulting from a single application of organic matter, depended to considerable extent, upon the type of organic material, and the rate of decomposition. Antipov (1956) stated that structural aggregates