ORGANIC MANURES AS A SOLUTION FOR SOME PROBLEMS IN CALCAREOUS SOILS

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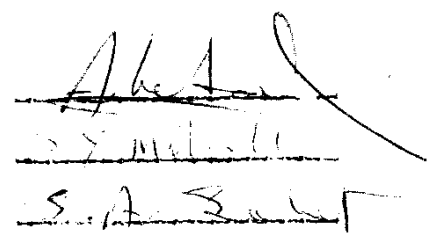

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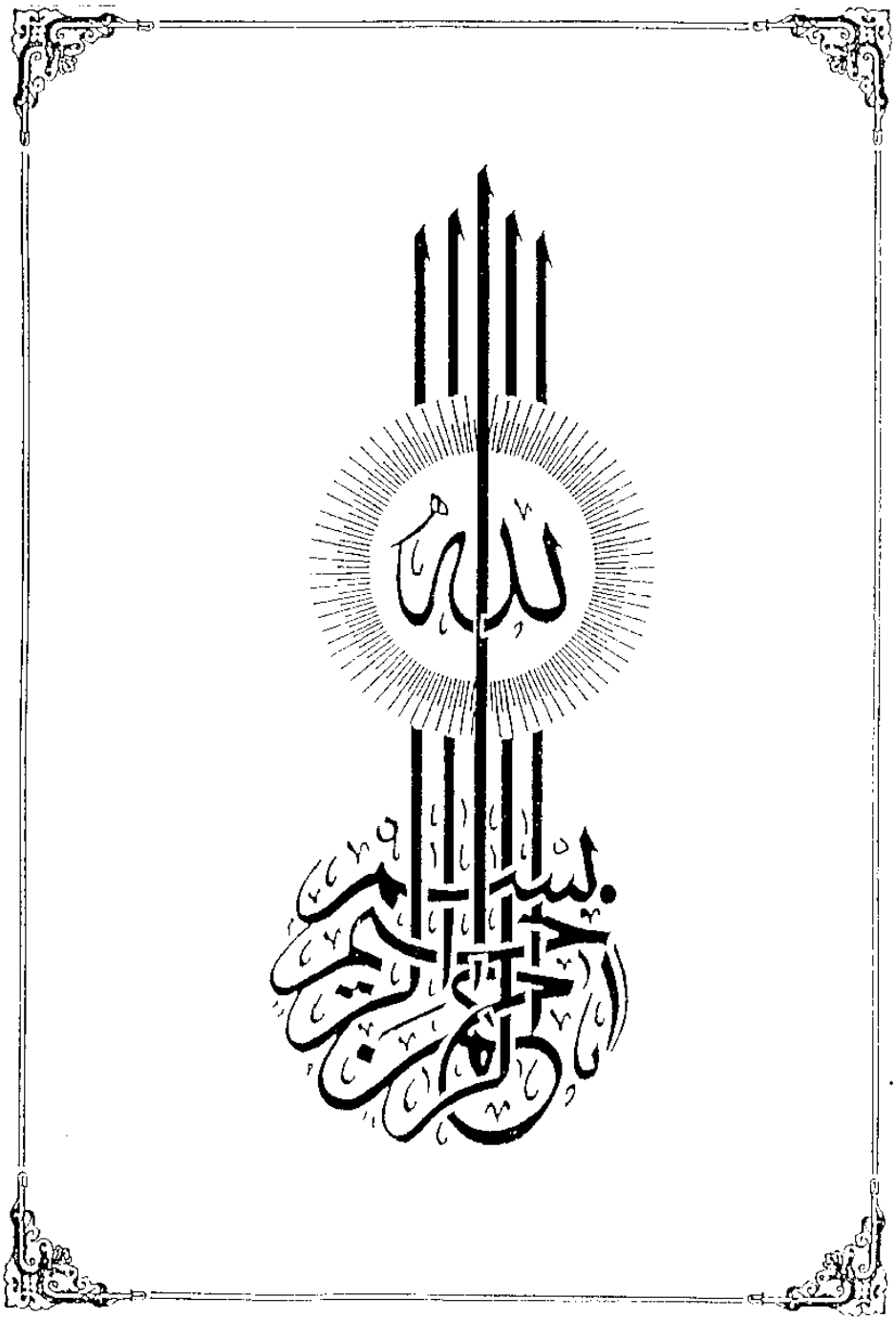

A C K N O W L E D G M E N T

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I N T R O D U C T I O N

Due to the problem of intense population and costs of living, several countries started to bring new lands under cultivation most of which were calcareous soil in nature; such soils are known to have many problemssome of which are of no definite solution.

Calcareous soils, as defined by El-Gabaly (1972), are those soils containing amounts of calcium carbonate enough to affect distinctly the soil properties related to plant growth, whether they are physical or chemical such as the availability of plant nutrients. In Egypt a great section of soils under reclamation is located to the west of Nile Delta in a strip extending from Alexandria to Lybia. Generally, the $CaCo_3$ content of such soils varies between 10 to 90 % but mostly between 10 - and 50 %.

Up to the present, no proper technique has been found to much improve their features or to ensure a continuous supply of their nutrients to growing plants. An emphasis has been placed however on the use of manures to take part in solving some problems of such soils high in their $CaCO_3$ content. According to that, manures

variable in their chemical composition would be of great interest. Their effect on the physical and chemical properties of soil as well as the availability status of some nutrients have been investigated.

2- REVIEW OF LITRATURE

The rate of decomposition for different organic materials is usually controlled by many different factors some of which are the nature of added organic material, its chemical composition and C:N ratio, El-Damaty et al ,(1969). Environmental conditions under which decomposition is achieved especially those related to soil areation, moisture supply and features such as soil reaction , are also involved, Waksman & Tenney (1927) and Martin & Kleinkauf (1941).

To facilitate the evaluation of organic matter as a solution for some problems of calcareous soils, it is thought advisable to present the reviewed literature under the following headings :

1- Influence of organic matter application on the physical properties of soil.
2- Influence of organic matter application on the chemical properties of soil.
3- Influence of organic matter application on the availabilety status of some nutrients.
4- Influence of organic matter application on the growth of plants and their uptake of nutrients.

2.1 Influence of organic matter application on the physical properties of soil.

2.1.1- Aggregation , bulk density and porosity

Browning (1937) and lyon & Buckman (1938) pointed out that organic matter played an important role in the formation of desirable soil structure by development of large aggregates which increased the porosity. The same observations were reported by Bordas and Huguet (1950) on a calcareous soil treated with green manure in the form of young maize in situe, amounting to 60 metric tons/ha , plant material and by Kute & Mann (1968) in field experiments on sandy loam soil. Stakman(1961) also showed that porosity increased when mixing peat with mineral soil (10% by volume), application of peat at ratio greater than 1:1 was however, not economical or practical.

Antipove (1956) stated that structural aggregates were mainly formed in calcareous soils by binding of humic acid with exchangeable calcium or by their adsorption on the surfaces of calcium corbonate - Helstead and Sowden(1963) added that the organic amendements (lucern, green rye and muck), applied during a period of 20 years usually increased the aggregate stability of clay soils.

Browning and Milan (1949) reported that the aggregates were signifcantly increased with increasing the units of organic matter. They added that the change in aggregation resulting from single application of organic matter was dependent to considerable extent, upon the type of organic material and the rate of decomposition. Baver (1961) added that the readily organic decomposable materials were great in its effect upon aggregation. The effect of decomposing straw on aggre ation disappeared much sooner than those of alfalfa. Biswas et al (1964) also reported that continuous treatments of farmyard and green manures in combination with super gave lower values of soil bulk density and higher values for water stable aggregates. Similar data were also obtained by Darra et al (1968) on a calcareous clay. loa. soil supplied with organic residues of sesbania and crotolaria juncea. later in (1971), Biswas and Ghosila showed that the long term effects of manures were also observed on alluvial black red andlateritic soils.

Abu-Zayed (1973) showed that with increasing the cropping period in calcaresus soils, the porosity slightly increased from year to year due to the gradual increase in the organic matter content. Moreover, the

decay of root system distributed in the surface and subsurface layers left channals responsible for low values of bulk density and higher values of porosity.

2.1.2. Permeability and hydraulic conductivity:

Hillel and Gardener (1970) showed that the infiltration through calcareous soils could be improved by addition of organic matter and allowing crops waste to decay in soils.

Moser (1939) and Alderfer & Merkle (1942) found that organic matter content was closely correlated with permeability and percolation rate of water. Biswas et al (1964) added that continuous treatment with farmyard and green manure was favourable for soil in permeability. Recently, Tomhan and Motirmani(1970) showed that permeability of soil usually decreased with depth, as the sub-soil layers were more compacted and low in organic matter content.

Abu-Zayed (1973) showed that the hydraulic conductivity in the virgin calcareous soils was generally very low as compared with the dultivated ones. By

increasing the cropping period, the hydraulic conductivity increased in the surface layers possibly due to the increase of organic matter content and porosity.

2.1.3. Soil moisture constants

The investigation of soil moisture constants has been of interest to several investigators.

Stauffar (1936), Coile (1953), Pathak (1954) and Metwally et al. (1969) Showed that addition of different organic manures was favourable for both of moisture equivalent and wilting coefficient as well as available water particularly in light textured soils.

Klute & Jacob (1949) and Russell et al (1952) obtained a highly significant positive relationship between organic matter conent of soil and each of moisture equivalent, wilting coefficient and available water, Higher values were obtained for the surface layers than for the subsurface ones of homogenous profiles due to the higher organic matter content of the surface layers.

Recently, El-Abbaseri et al (1971) and Abu-Zayed (1973) found an increase in moisture equivalent of

calcareous soils with increasing the period of cultivation.

Bordas and Huguet (1950) treated a calcareous soil with green manure in the form of young maize in situ , amounting 60 metric tons/ha plant material. They showed that water retention had risen 2.1 % above that of untreated soils. Similar results have been reported by Biswas and Khosla (1971) who showed that the long term effect of manures on alluvial black red and laterite soil improved the water retention and availability particularly in light textured soils.

2.2 - Influence of application of organic matter on the chemical properties of soils.

2.2.1 - C : N ratio:

Organic manuring is essential for building up the organic matter content in soil whose C:N ratio is usually dependent on kind of manure applied.

Bordas and Huguet (1950) treated a calcareous soil with green manure in the form of young maize grown in situ amounting 60 metric tons/ha. of fresh plant material. Results showed that organic matter content rose by about 50 % and extractable humic acid by 100% after six months of manure application. They added that the C/N ratio was increased from 5.5 to 7.7 at the surface and to 9.4 in the 0 - 30 cm layer below which it was unchanged. Moubarek (1960) also showed that the organic matter content in sandy soils of Tahreer provence increased progressively from 0.008 to 0.34 % after five years of cultivation, and associated with remarkable increase in the soil C/N ratio, Addition of green manure increased the indicated C/N ratio from 3.3 to 7.1, then it decreased to 5.4 at the end of incubation period. Also, the C/N ratio was found to be