WATER REQUIREMENTS FOR COTTON IN QALUBIA GOVERNORATE

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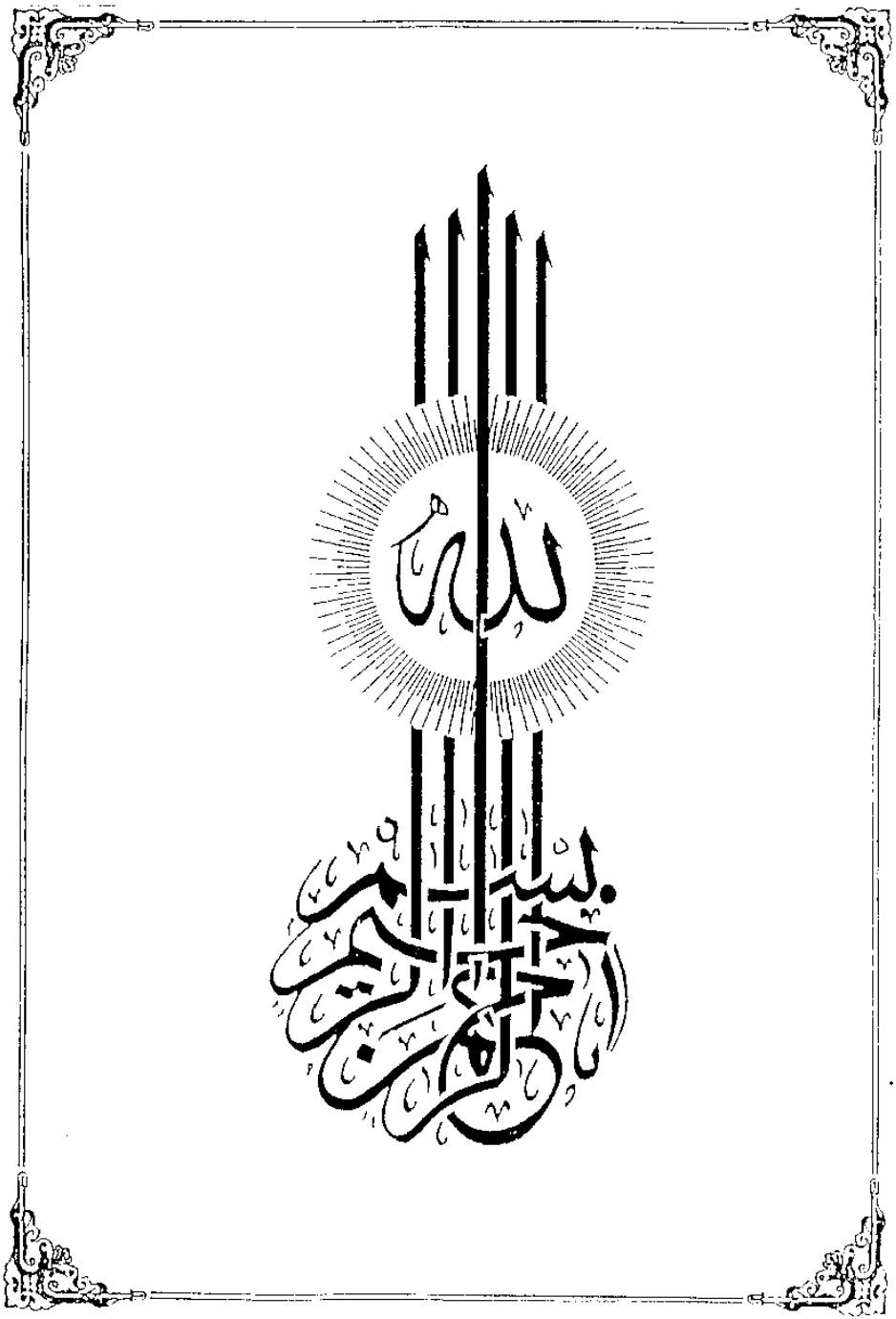

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I. INTRODUCTION

It is well known that soil water plant relationship is a basic important subject in agriculture sciences particularly in arid and semi arid regions. In Egypt, agriculture has always been depended essentially on irrigation water from the river Nile. The increase rate of population has so far surpassed the increase rate of cultivated land, and any expansion is hindered by the shortage in the stored irrigation water and the natural discharge of the river Nile. Asswan High Dam is very important for this purpose. However the accomplishment of maximum benefit from the large volumes of water, which are stored by this dam requires reconsideration of the current irrigation policy. Of course, this policy must be based on comprehensive knowledge of the actual needs of various crops to water, and of the correct distribution of these needs throughout the growth season. The extent of any agriculture development or increase in agriculture production is based on the sufficiency of the available water resources and on the measures taken to permit maximum economical return per unit of irrigation water. This can be reached through the improvement of irrigation methods from the engineering side and more important, by adapting the proper and flexible designs which allow supplying the plant roots with favourable amounts of water in the current time.

Cotton is one of the most important crops in Egypt, and represents the backbone of the agriculture income. Thus, the current work was carried out to study the effect of different levels of irrigation water, added at different soil moisture tensions, on the yield and some properties of cotton plant, and also to reveal the best irrigation regime, that can be adopted in Qalubia Governorate. Also this work was conducted to study the effect of different irrigation regimes on some physical and chemical properties of soil.

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II. REVIEW OF LITERATURE

II.I. The Effect of Irrigation Frequencies and Levels on Some Physical Properties of Soil.

1. Soil Structure

Soil structure is one of the best indicators for soil physical properties. Irrigation water had a clear effect on structure and other physical properties of the soils.

Rodionovsky (1938) noticed that under favourable moisture conditions structural units, and aggregates with diameters less than 0.25 mm. in the studied soil horizons decreased while those of diameters more than 0.25 mm. increased. Sunkel(1963) in his study on the effect of moisture content on the amount of aggregates of 2-3 mm in size, found an increase of aggregate percentage up to 27% at 20% moisture content compared with that of air dried soil. Haslbach (1964) indicated that irrigation increased the fine fraction in soil by increasing the intensity of weathering,and displaces this fraction to a compacted accumulation horizon at 40-80 cm. depth. Irrigation also harmfully affects soil structure by increasing the number of aggregates 0.25mm in size and decreasing water stable

aggregates especially in the upper horizons. Mijhawan and Garg (1974) showed that soil structure of cultivated soils especially those under canal irrigation has been improved as indicated by the physical soil characteristics, like, non-capillary, pore spaces, water holding capacity, infiltration rate and porosity. Gabriels and Boodt (1975) stated that the optimal soil moisture for aggregates formation in plow layer samples of heavy loam soil, corresponded to about 80% of the water field capacity value. Also Boiffin(1976) found under laboratory conditions that low stable aggregates rapidly developed under excess water conditions, while high stable aggregates only developed under prolonged dry conditions in the presence of a certain minimum amount of water.

2. Bulk Density and Porosity

Bulk density and porosity are affected by some factors such as soil structure, texture, swelling and shrinking and moisture content.

Kelley (1951) found that alternate wetting and drying lead to increase the soil porosity. Also Zein El Abedine et al (1962) in Giza soils, noticed that the apparent density decreases after irrigation, while

before irrigation, it tends to increase by the advancement of the season. Also they found at the end of the season that the apparent densities of the soil profile are of higher values in the treatment that received irrigation water at the rate of 3793 m^3/fed. than in those received 3351 m^3/fed. Concerning the pore spaces, they found an increase in its values after irrigation than before irrigation and these values are greater in the second treatment than in the first before and after irrigation. Cherbar(1971) found in Vakhshsk Valley, USSR that the values of density, porosity, water permeability and the specific weight of the soils depend on their moisture regime and the length of time for which they have been irrigated. As the length of time for which the soil has been irrigated increases, the density of the soils increases and their porosity and permeability decrease. Increases in density are particularly great in the plowed layer and the horizon beneath it. Slesareva and Ryzhov (1972) stated that the sizes of the mechanical composition and internal porosity of the aggregates affected the bulk density and total porosity of the soil. They found also that the bulk density decreased during seeds germination and irrigation of cotton and by application of certain polymer.

3. Infiltration Rate

It is a well known fact that the design of irrigation and drainage systems depend greatly on soil permeability and infiltration rate which are influenced by the physical properties of the soil.

Salter and Byers (1931) observed that the field percolation rate was governed by the water passageways such as root channels and by the pore space volume. Also Lutz and Leamer (1939) pointed out that soil structure, swelling and shrinkage affect the hydraulic conductivity more than soil texture does. Williams and Doneen (1960) found in alluvial soils, developed in a Mediterranean-type climate conditions, that graminous summer and winter green manures improved water infiltration comparing with fallow soil. Green (1963)found a marked decrease in infiltration rate with increasing antecedent moisture levels. Antecedent moisture differences on a given soil could influence infiltration rates as much as tillage, surface sealing or profile differences between soils. Gumbs and Warkenoin (1972) studied the effect of bulk density and initial moisture content on infiltration in clay soil sample . They ensured that infiltration decreased with increasing bulk density, and it is larger at higher initial moisture content. Sarochkin (1973) emphasized that the