RECLAMATION PROCESSES AND THEIR EFFECTS ON SOME SOIL PROPERTIES AND CROPS YIELD IN DETERIORATED SOILS, NORTH DELTA, EGYPT

BY

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INTRODUCTION

1. INTRODUCTION

Soil salinity and alkalinity affect several physical and moisture properties such as structure, bulk density, hydraulic conductivity and infiltration rate. Also soil chemical properties and availability of plant nutrients are influenced by salinity and alkalinity.

In Egypt one million hectars of irrigated area is salt affected and have very low yield potentials. Most of these deteriorated area are located in the Northern and Eastern parts of Nile Delta. Such areas should be reclaimed to meet the demand of increasing population in Egypt.

The problems of these soils include :

1- Poor physical conditions, i.e. poor permeability to water and air due to high exchangeable sodium, type of clay mineral and other colloidal products.

2- Strong alkalinity and high pH especially in the surface layers.

3- Low availability of many nutrients .

The common reclamation processes applied in Egypt for these soils include:

1- Improvement of soil physical and chemical properties through deep ploughing and addition of different amendments such as organic manures, lime and gypsum which is the most commonly chemical amendment used in Egypt due its low cost and ease of application.

2- Replacement of adsorbed Na^+ on exchangeable complex by Ca^{++}, and removal of the products of this process through leaching and drainage.

3- Use of suitable qualities and requirements of irrigation water in the presence of suitable drainage system.

The current work was carried out to study the effect of some reclamation processes on some physical and chemical properties and production of deteriorated soils in the Northern part of Nile Delta.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

2.1- Some physical properties of saline alkali soils:

It is well known that soil physical properties are of the great importance in agricultural production. Such properties as bulk density, porosity, hydraulic conductivity, infiltration rate, and soil aggregation are governed by many factors associated with each other.

2.1.1- Soil bulk density and total porosity:

Soil bulk density and porosity are affected by some factors such as, soil structure, texture, swelling, shrinking and moisture content. Baver (1965), found in saline soils that high salt content always bring flocculation to the dispersed particles. Mostafa, (1969) stated that high values of bulk density for virgin soil may be partially due to the high values of exchangeable sodium. Mahlad et al. (1974) revealed that soil bulk densities are decreased with the increase in ionic radii. Also, porosity is rather higher for divalent than for monovalent adsorbed cations. Talha et al.(1978) stated that , ESP is positively correlated with fine capillary pores and negatively with coarse capillary, water holding volume, and quickly drainable pores. So, increasing the ESP values resulted in an increase of non - useful pores and decrease in air capacity. However, the relationship between ..

T.S.S and water holding pores and percent of total porosity is negative and significant. Talha et al.(1979) pointed out that increasing ESP shows insignificant effect on bulk density or total porosity but it has a significant effect on pore space distribution.

El-Mowelhi et al. (1982), in their study on saline sodic soils, pointed out that the values of bulk density ranged from 1.4 to 1.33 g/cm^3. Abo-Soliman (1984) found that the effect of soil salinity is attributed to the hydration shell, as well as, the relatively high moisture content which, in turn, decrease the bulk density. On the other hand the effect of soil alkalinity is rendered to the dispersion effect of sodium ions which leads to relatively high bulk density and decreases the total porosity values. He stated also that, a significant relationship was found between bulk density and total porosity, on one hand, and ESP on the other hand ($r = +0.44$ and -0.50 respectively).

2.1.2- Hydraulic conductivity:

Martin and Richards (1959) showed that increasing the exchangeable H^+ and Ca^{++} causes a very little increase in hydraulic conductivity, whereas increasing the exchangeable sodium and potassium reduced it markedly. On the other hand, Hamdi et al. (1968) found no relationships between hydraulic conductivity of alluvial soils and both the divalent and monovalent exchangeable cations.

Zien El-Abedien *et al.* (1968) found that water soluble salts either in soil or in irrigation water play an active role in changing exchangeable bases and physical properties of the soil, which in turn, are reflected on soil water permeability or conductivity. The greater $Na^+: Ca^{++}$ in the irrigated soils the lower is permeability coefficient, while the permeability coefficient increases at high ratio of $Ca^{++}: Na^+$. Ahmed *et al.* (1969) found that hydraulic conductivity was affected by four cations in the order: $Ca^{++} > Mg^{++} > K^+ > Na^+$. Mostafa (1969) pointed out that the effect of different soluble salts on permeability coefficient could be arranged in the following descending order; $CaCl_2 > MgCl_2 >$ NaCl. He added that sodium saturated soils do not drain well, and exchangeable calcium can improve their permeability. Mukhtar *et al.* (1974) pointed out that hydraulic conductivity increases with increasing electrolyte concentration. He found also , a negative correlation between (ESP) and hydraulic conductivity. Talha *et al.* (1979) stated that the decrease in hydraulic conductivity and infiltration rate values as ESP increases might be due to the highly and significant decrease in total and quick drainable pores. He added that, the increase of hydraulic conductivity with the increase of total soluble salts was not pronounced for soil having low ESP values. This might be due to the effect of high alkalinity on hydraulic conductivity. Tayel *et al.* (1980) found that soil hydraulic conductivity changed according to salt concentration, matric potential, and Na^+: Ca^{++}: Mg^{++} ratio, whereas hydraulic conductivity decreased with increasing salt concentration at any given matric potential. Also, it increased with increasing matric potential at any given salt concentration, on the other hand, the hydraulic conductivity decreased as SAR increased. Bresler et al. (1984) showed that soil salinity (E.C) accounted for only 10-15% of the variability of soil hydraulic conductivity (K_n), texture (percent of sand) explained 25 to 45% of K_n variability and 10 to 15% of the variability was explained by the interaction between salinity and texture.

2.1.3- Infiltration rate:

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. Gumbs and Warkenion (1972), studied the effect of bulk density and initial moisture content on infiltration in clay soil samples, they ensured that infiltration decreased with increasing bulk density, and increased with higher initial moisture content. Maklad et al.(1974), pointed out that the amounts and type of clay mineral, the nature of adsorbed ions on the soil adsorping complex show an effective role as far as the soil water characteristics are concerned. Permeability coefficient have been influenced by the adsorbed ions according to the descending orders :

$$Na^+ > NH_4^+ > K^+ > Mg^{++} > Ca^{++}$$

Talha et al. (1979) stated that the decrease in infiltration rate values as ESP increased might be due to the highly and significant decrease in total and quick drainable pores. They added that, the quick drainable pores have the highest indirect effect on infiltration rate while ESP has the highest direct effect. Ghazy et al. (1984) found a sharp decrease on water movement as the effect of ESP. This might be due to the fact that increasing ESP decreased the number of aggregates as well as their stability and hence decreased total pores. Abo-soliman (1984) found that the hydraulic conductivity and infiltration rate values could be arranged in the descending order: normal soils > newly reclaimed salt affected soils > saline soils > alkali soils. Also, he added that infiltration rate values decrease in the alkali soils due to the increase of ESP values, which encourage the dispersion action of soil aggregates. He also found that the correlation coefficient between infiltration rate and ESP was negative and highly significant (r= -0.86).

2.1.4- Aggregate stability:

Aggregate stability measurement is one of the most common determinations of pore size distribution. The stability of structure is referred to the resistance of soil aggregates to disintegrating influence of water and