CONTENTES

5- SUMMARY

This investigation was carried out to study the effect of different individual and combined treatments of irrigation water salinity and phosphatic fertilization on physical and chemical properties of calcareous soil and productivity of barley and its content of nutrients. This study was carried out on five calcareous soils having different content of calcium carbonate from the area of Elbostan (Behera Governorate), Terat El-Nasr (Alexandria Governorate), Kilo 52 Cairo-Alexandria Desert Road (El-Giza Governorate), El-Nobariya (Behera Governorate) and Borg El-Arab (Alexandria Governorate). So the following experiment was carried out.

In pot experiment, the used five calcareous soils were fertilized by superphosphate (15.5% P_2O_5) at application rates of 0, 50, 100 and 200% of the recommended dose(RD) of barley plants (300 kg superphosphate per feddan)(0, 0.15, 0.3 and 0.60 g superphosphate/ kg). the pots were sown by barley seeds. Other different agricultural treatments were carried out. The pots were irrigated every three days by alternation between the tested synthetic saline solutions and tap water by 2,1 at 60% of water holding capacity. The first two synthetic saline solution have EC value of 1000 dSm^{-1} and SAR 6,31 and 23,26, where the others solutions have EC value of 2500 dSm^{-1} and SAR of 9,97 and 36.75. The pots and the treatments were arranging in split-split design with three replicates. At harvest stage the plants were harvested and divided into straw and grains. Plant samples were dried and analyzed for its content of N, P and K. the soils were analyzed for some physical and chemical properties, activity of calcium carbonate and the content of different P forms. The obtained results may be summarized as follows:

1- **Soil physical and chemical properties**.

- Soil bulk density, total porosity and hydraulic conductivity were increased with the increase of irrigation water salinity, while they decreased with the increase of sodicity level.
- The soil content of $CaCO_3$ was increased with the increase of salinity and sodicity levels in the irrigation water while the active percentage was increased.
- Soil content of total soluble salts and soluble ions were increased with the increase of salinity level while soil pH was increased with the increase of sodicity level of irrigation water.

II- Phosphorus forms:

a-Total-P (P_{-T}).

- Positive and significant increase of soil content of P_{-T} was found with the increase of added P.

- Soil content of P_{-T} was also increased with the increase of irrigation water salinity and sodicity. The obtained increases were varied from soil to another.

b) Available –P (P_{-Av}).

- The increase of added P resulted in a significant increase of soil content of available –P.

- The high content of P_{-Av} was found in soil3. where the lowest was found in soil1.

- The soil content of P_{-Av} was increased with the increase of salinity and sodicity level of irrigation water.

- Positive and significant relationships were found between the soil content of P_{-Av} and either of added fine fraction or soil pH and it were positively with the soil content of O.M and coarse fraction.

c) Organic - P (P_{-Or}).

- The studied calcareous soil overe characterized by low content of P_{-Or} where this content represented less than 10% of P_{-T}.
- The high content of P_{-Or} was found in soil3, where the lowest one was found in soil1.
- The soil content of P_{-Or} was increased significantly with the increase of added P.
- The content of P_{-Or} was deceased with the increase of irrigation water salinity and sodicity levels .
- The relationships between the soil content of P_{-Or} and each of fine fraction, pH, O.M and $CaCO_3$ were positive, where were negative with course fraction and active $CaCO_3$.

d) Inorganic (mineral)-P (P_{-I}).

- The high content of this form as a percentage of P_{-T} (91.58%) was found in soil 3 irrigated with water having high levels of salinity and sodicity and fertilized by high P level, where the lowest one (88.51%) was found in $soil_5$ irrigated with tap water without any P fertilization.
- The high content of P_{-I} was found in soil $_4$ where the lowest was found in soil $_1$.
- The content of P_{-I} was increased with increasing salinity and sodicity of irrigation water. Also this content was increased with increasing the content of fine fraction, OM and total $CaCO_3$ and decreased with the increase in soil bulk density and the content of fine fraction.

d-1) Calcium-p (P_{-Ca}).

- The studied calcareous soils were characterized by high content of P_{-Ca}. This content represent more than 60% of P_{-I}. the high content of this form (125.98 $mgkg^{-1}$) which represented 77.98% of P_{-I} was found in $soil_3$ irrigated with high salinity and sodicity levels of irrigation water.
- The contents of this form were increased significantly with increasing of added P. For example, this content in $soil_3$ irrigated by water having

high salinity and sodicity levels increased from 56.92 mg/ kg in unfertilized soil to 88.34 $mgkg^{-1}$with high level of added P.

- The high content of this form was found in the soils irrigated by water having high salinity and sodicity levels.

d-2) Aluminum-(P_{-Al}).

- P_{-Al} content in the used soils under different treatments represented from 8.0 to 13.0% of P_{-I}.

- This content was increased significantly with the increase of either added P or the levels of salinity and sodicity of irrigation water. For example, the content of P_{-Al} in soil 1 irrigated with water having high levels of salinity and sodicity was increased from 2.12 $mgkg^{-1}$ in unfertilized soil to 17.37 $mgkg^{-1}$ at high application rate of P.

d-3) Iron-P (P_{-Fe}).

- The soil content of P_{-Fe} ranged between 0.13 and 1.52 mg/kg which represent 0.56 and 1.16 % of P_{-I}.

- With different soils, the high content of P_{-Fe} was found in the treatment of tap water at high application rate of P.

d-4) Residue-P (P_{-R}).

- The content of P_{-R} ranged from 4.78 to 13.60 of P_{-I}. This content increased significantly with the increase of added P.

- The high content of P_{-R} was found in the soils irrigated with tap water and increased with the increase of irrigation water of salinity and sodicity levels.

III- Dry matter yield of barley plants.

- The high yield ($gpot^{-1}$) of barley straw and yield was found in the soil1 while the lowest one was found in soil5.
- The yield of both straw and grains was significantly increased with the increase of added P, while it decreased with the increase of irrigation water salinity and sodicity levels.

- The relationship between the obtained dry matter yield of straw or grains and the soil content of fine fraction , O.M , P_{-Av}, Bulk density and hydraulic conductivity were positive where its were negative with soil content of $CaCO_3$, pH , porosity (%) and silt and clay.
- The significant levels of the previous calculated relationships were varied from one to another.

IV-Nutrients content of barley plants:

a)Nitrogen (N).

- Nitrogen concentration (%) of both straw and grains was decreased with the increase of the levels of either added P or salinity and sodicity of irrigation water, while N uptake ($mgkg^{-1}$) was increased with the increase of added P and decreased with the increase salinity and sodicity levels of irrigation water.

- The obtained relationships between barley (straw and grains) uptake of N and soil bulk density content of course fraction and hydraulic conductivity were positive and significant, where it were negative and significant with fine fraction soil, pH and the content of $CaCO_3$.

- The negative effect of salinity and sodicity irrigation water on N content of straw and grains was significant, where relations were positive and significant with soil content of P_{-Av} , P_{-Al} and P_{-Fe}.

b) Phosphorus (P).

- Phosphorous content (concentration and uptake) of both straw and grains was increased significantly with the increase of added P, while it decreased with the increase salinity and sodicity levels of irrigation water.

- The relationships between P uptake by straw and grains of barley plants and the content of $CaCO_3$ (total and activie) fine fraction. pH and soluble ions were negative where it were positive with bulk density, course fraction, hydraulic conductivity, P_{-Or} and P_{-Ca}.

- The significant levels of these relations were varied from one to another.

c) Potassium (K).

- Potassium, concentration (%) and uptake ($mgkg^{-1}$) of straw and grains was increased with the increase of added P and decreased with the increase of irrigation water salinity and sodicity.
- The relationships between K uptake by barley plants (straw and grains) and bulk density, course fraction, hydraulic conductivity, P_{-Av}, P_{-Al} and P_{-Fe} were positive where it were negative with fine fraction, soil pH, $CaCO_3$ (total and active), P_{-Ca} and P_{-Or}.