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# 5. SUMMARY

Soil salinity and alkalinity affected several soil physical and chemical properties and availability of plant nutrients. Most of saline and alkali soils in Egypt are located in the northern and eastern parts of Nile Delta and have very low yield potentials.

A field experiment was conducted at Sakha Agricultural Research Station farm, Kafr El-Sheikh Governorate, Egypt, to study and evaluate the effect of some amelioration processes on the salt affected soil properties and its content of nutrients, also the effect of the studied processes on Sweet sorgham (*Sorghum Vulgara* var *saccaratum*) Piper) staph growth. Soil profile of the studied area was done, disturbed and undisturbed soil samples were taken at depth 0 –15, 15-30, 30-60 and 60-90 cm were taken. The disturbed samples were air-dried, ground, sieved through a 2 mm sieve and kept for some chemical analysis and its content of some macro-and micro nutrients, The physical properties were carried out on the undisturbed samples.

The experimental area was 2100 $m^2$. A split-split plot design with four replicates was adopted. The plot area was 24 (4 × 6) $m^2$. The main plots were assigned to subsoiling (S) treatments at depth 60 cm). Three gypsum rates were added, (zero) control; ($G_1$) 50% half amount of gypsum requirements (G.R.) 5 ton/fed and ($G_2$) 100% G.R. (10 ton/fed), the sub-subplots were occupied by two application rates of farmyard manure (FYM), at (zero) control and (O) 20 $m^3$/fed. FYM were added through tillage processes. The field experiment was cultivated with sorghum (*Sorghum Vulgara*).

The obtained results can be summarized as follows:

## ♦ THE EFFECT OF DIFFERENT AMELIORATION PROCESSES ON SOME SOIL CHEMICAL PROPERTIES:

**- Soil salinity:**

The ECe values reduced in the surface layer as a result of gypsum application after first cut and after second cut. The subsoiling operation at 60 cm reduced the ECe also after first and second cut. The organic manure addition alone had no effects on reducing of ECe but the application of organic manure followed by subsoiling operation had a pronounced effect on ECe reduction. Finally it can be concluded that the best amelioration processes used in this study for reducing ECe are application of gypsum requirement and organic manure addition (20 m3/fed) and mixing these amendment in the soil with subsoiling operation to 60 cm depth ($SG_2O$) followed by ($SG_1O$).

**- Soluble cations and anions:**

The values of both $Cl^-$ and $Na^+$ in the surface layers indicated that both ions were the highest ions to be removed from the soil after first and second cuts. The best treatment was $SG_2O$.

Magnesium was generally decreased after first and second cut, as a results of application of treatments, but potassium ions were generally increased in the treatments containing organic manure.

The soluble bicarbonate were generally slightly decrease after both first and second cut while the soluble carbonate were absent in all soil layers.

The soluble $Ca^{2+}$ was increased with increasing gypsum application rate as well as in the treatments that contain organic manure application.

The soluble sulphate concentration take the same trend detected for soluble $Ca^{+}$.

**- Effect of amelioration processes on SAR and ESP values:**

SAR and ESP values were decreased after both cuts due to the application of either 50% G.R. ($G_1$) or 100 % G.R. ($G_2$) and the reduction in ESP value is higher in the case of $G_2$ treatment comparison with ($G_1$).

The values of SAR and ESP were decreased as a results of subsoiling compared with control after first and second cut. Finally the treatment ($SG_2O$) is the most effective practice in reducing SAR and ESP values.

**- Effect of amelioration processes on total $CaCO_3$%:**

Total $CaCO_3$ % in the soil increases as a result of increasing gypsum application rate, while farmyard manure addition caused a decrease in $CaCO_3$% in soil especially after the second cut.

**- Effect of amelioration processes on organic matter (O.M.) content:**

The application of farmyard manure (FYM) either alone or combined with subsoiling and/or gypsum led to a marked increase in soil organic matter in the surface layers of soil after first cut.

**- Effect of different amelioration processes on soil pH**

The lowest values of soil pH were related to the precence of high rate of gypsum 100% G.R., while slightly decrease in soil pH was detected after the addition of FYM.

- **EFFECT OF AMELIORATION PROCESSES ON SOME SOIL PHYSICAL PROPERTIES.**

- **Soil bulk density and total porosity:**

Soil bulk density were decreased throughout different soil layers and accordingly increase total porosity as a result of addition of 100% G.R. compared to the control. The effect of gypsum treatments on soil bulk density and total porosity was more clear in the surface layers of soil profiles. Subsoiling had a decrease effect on soil bulk density and an increase effect on total porosity compared to the control. The effect of the studied amelioration processes indicated that bulk density decreased and total porosity increased.

- **Infiltration rate (I.R.)**

The highest values of I.R. were recorded with the treatments of $SG_2O$ after first and second cut as a result of addition of gypsum, then FYM followed by subsoiling.

- **Hydraulic conductivity (K)**

The addition of G.R. ($G_2$) and FYM (O) to the uper soil layers flowed by subsoiling (S) (treatment of SG2O) is the most effect treatment for increasing soil hydraulic conductivity (K) where the values of (K) increased from 0.059 and 0.061m/day (control) to 0.138 and 0.19 m/day after the first and second cut respectively.

- **Aggregation parameters:**

The application of G.R. combined with FYM and subsoiling ($SG_2O$) was the most effective treatment in increasing all studied aggregation parameters ( i.e. AI, S.C., M.WD. $OP_tS$, WSA) than that each treatment alone. The treatments can be arranged in the following

descending order from improving aggregation parameters point of view. $SG_2O$> $SG_2$>$G_2O$>$SG_1O$>$G_1O$>SO>$SG_1$>$G_2$>O>$G_1$>S>C.

- **EFFECT OF AMELIORATION PROCESSES ON NUTRIENTS AVAILABILITY AND ITS VERTICAL DISTRIBUTION.**

**Macro and micronutrients.**

- Available N, P, and K decreased with the increase of soil depth under different amelioration treatments. The soil content of available N, P, and K was decreased in control plots after harvesting compared to control. The lowest increase in available N was found in S treatment only, where the highest one was found in $SG_2O$ treatment especially in the surface layer (0-15 cm) after first cut.

- The available P in plots treated by SO treatment was more than those found in the other plots. Also, available P decreased with increase of soil depth this decrease attributed to the decrease in the soil organic matter with depth.
- The highest content of available K at different layers of soil depth was found with ($SG_2O$ treatment) and the lowest value of available K was found with control (C). Generally, the treatment conculuded gypsum applications results in an increase of available K.
- The highest content of available Fe was found in $SG_2O$ treatment (11.2 and 15.12 ppm) in the surface layer and the lowest value was found in the control (12.1 and 12.58 ppm) at the first and second cut respectively.
- The highest values of available Mn were found in $SG_2O$ treatment followed by $SG_1O$ while the lowest value were found in the control

after first and second cuts. Generally gypsum treatment gave the high amount of available Mn.

- The highest value of available Zn found in $SG_2O$ treatment (2.38 and 1.5 ppm) in the surface layer at first and second cut respectively. While it was 0.96 and 0.38 ppm in the control at first and second cut respectively. Available Zn clearly decreased with increasing soil depth, also, subsoiling and organic matter treatments increased Zn availability.
- The higher increase of available Cu was found with $G_2$ followed by O. the highest value of available Cu were found with $SG_2O$ (3.22 and 2.74 ppm) in the surface layer compared with control (1.14 and 0.64 ppm) at first and second cut.

♦ **DRY MATTER YIELD:**

- The dry matter yield of sorghum plants increased significantly after soil treated with different amelioration processes. The highest increase were found with $SG_2O$ treatment (0.730 and 0.862 kg/fed), while the lowest increase was with control C (.0.192 and 0.222 kg/fed) at first and second cut respectively.
- The highest values of dry matter yield relative increase (R.I.%) were found with $SG_2O$ (280.2 and 288.29%) at first and second cut respectively.

♦ **MACRONUTRIENTS CONTENT AND UPTAKE:**

- The concentration % and uptake of N, P, K, Ca, Mg, and Na by sorghum were increased under different amelioration processes conditions, these increase were more clear in the treatment including the three amelioration processes.

- The high content of the studied macronutrients was found for K followed by N where the lowest content was for Mg as a result of different amelioration processes. The low conc. Of sodium were detected with treatments $SG_2O$ and $SG_1O$ while the high concentration of Na was achieved with control.

♦ **MICRONUTRIENTS CONTENT (UPTAKE)**

The concentration and uptake of the determined micronutrients Fe, Mn, Zn, and Cu by sorghum plants were increased as a result of different amelioration processes, these increase were more clear in the plants grown in soil treated by $SG_2O$ treatment.

The individual effect of each process on the micronutrients content of sorghum plants was less than that for double or triable treatments.

The highest concentration and uptake of the determined micronutrients were found with Fe followed by Mn where the lowest were found with Cu.