SUMMARY AND CONCLUSIONS

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The current study aims mainly at investigating the impacts of using different water qualities for intermittent leaching of some soils on the redistribution of soluble salts and ions in these soils. Effects of the same qualities of water on the redistribution of soluble salts were reexamined after being magnetized. Also studying the effect of using magnetized water on seed germination, seedling emergence was a matter of concern within this study.

Fulfilling the purposes of this study required collecting three soil samples namely, a clayey (alluvial) soil of EC 2.3 dSm^{-1}, a sandy clay loam (calcareous) soil of EC 11.0 dSm^{-1} and a sandy (noncalcareous) of EC 4.4 dSm^{-1}. Columns were packed uniformly with either of the investigated soils and underwent experimental work. This work involved a leaching trial through which soil columns were intermittently leached using different sequences of different poor water qualities alternatively with the tap water. At the end of the leaching process, each soil column was separated into 3 equal segments i.e. 0-15, 15-30 and 30-45 cm and chemically analyzed to monitor the redistribution of soluble salts as well as the ionic composition of the soluble salts within the different depths of the investigated soils.

Another laboratory experiment was conducted on similar soil columns subjected to the same way of intermittent leaching with either of the El-Bostan drain water (W_1), Seedy Ghazy drain (W_2), El-Hedaya canal water (W_3) or Haris drain water (W_4). This experiment was conducted once again using the same above mentioned water qualities but after being magnetized to illustrate the effect of magnetization of waters on their effect on redistribution and leaching of soluble ions within the different soil depths.

Also, an experiment was conducted under the laborator conditions, to determine the effect of magnetizing the investigate different water qualities on germination rate (G.R) and germinatio percent (G.P) of wheat grains.

The latest experiment was a greenhouse one conducted t investigate the probable effects of magnetizing the previously mentione irrigation water qualities on some chemical properties of soils and plan dry weight yield. The experiment was conducted in either the clay, th sandy clay loam (calcareous) or the sandy soil. Thirty grains of whea (Sakha _69) were planted in each pot. The pots were divided into tw groups into two groups the first groups of pots were irrigated with th different irrigation water qualities, while the second group was irrigate with the same types of water after being magnetized. After 45 days fro sowing, the fresh plants were weighed, washed with distilled wate dried at 70 ^{0}C and re-weighed to estimate the dry weight yield.

Soils remained in pots after removal of plants were sampled an analyzed, as mentioned before.

The obtained results could be summarized under the followin headings:

1. ***Effect of intermittent leaching using different elutio sequences on salinity and ionic composition of the differe segments of soil columns:***

- Leachability of the clayey soil under intermittent leaching using th different elution sequences was the least while that of the sandy o was highest. Thus, the different elution sequences seemed to be of mo pronounced effect on reducing salinity of both the sandy clay loam an sandy soils than the clayey one.

Depthwise distribution of soluble salts indicated relatively higher accumulation in the uppermost surface layers all the studied soils than the layers below.

- All the elution sequences resulted in reduction in HCO_3^- content of both the clayey and sandy clay loam soils but on the other hand caused general increase in HCO_3^- content of the sandy soil. HCO_3^- distribution with depth did not show a fixed pattern where its content differed within each soil due to type of the water used for leaching besides of the elution.

- Generally, values of soluble Cl^- in all depths of the investigated soils seemed to be lower upon of the elution sequence in which the water alternatively applied with the tap water was of lower EC value besides the sequences in which times of using the poor water quality was water were least.

The depthwise distribution of soluble Cl^- was similar to a great extent, to that of EC.

- Intermittent leaching using the tap water (W_0), the elution sequences in which El-Bostan drain water (W_1) or Seedy Ghazy drain water (W_2) was alternatively applied with the tap water decreased soluble SO_4^{2-} content of all depths of both the sandy and sandy clay loam soils. Increasing SO_4^{2-} content application of the drain water, however, soluble SO_4^{2-} more accumulate in the clayey soil.

Intermittent leaching of the investigated soils using El-Hedaya irrigation canal (W_3) seemed to be less effect on removal of soluble SO_4^{2-} out of the different depths of these soils. Moreover, alternative of the tap water with Haris drain water generally resulted in accumulation of the soluble SO_4^{2-} in the different depths of the investigated soils.

- Intermittent leaching using the different elution sequences generall resulted in reduction in soluble Ca^{2+} content of both the sandy cla loam and sandy soils whatever the water alternatively applied with th tap water was, however, intermittent leaching of the clayey soil resulte in contradictory results depending on the type of sequence used beside of type of the water used in this sequence.
- All the elution sequence resulted from the alternative usage of th tap water with either of the used qualities expect for that of Haris drai water reduced soluble content of Mg^{2+}.
- The of intermittent leaching using the different elution sequence on redistribution of soluble Na^{+} within the different depths of th investigated soils seemed to be similar to some extent, to that show on soluble Cl^{-}.
- Using the tested water qualities alternatively with the tap water i different sequences caused soluble K^{+} to increase in both the claye and sandy soils but to decrease in the sandy clay loam soil.

Depthwise distribution of Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} reveals th these cations were found to be generally highest in the surface laye however concentrations of these elements differed with depth dependin on quality of the water, type of the soil, and type of the cation itself.

2. ***Soluble salts redistribution in soils under intermittent leachin using magnetized and non-magnetized waters:***

Magnetizing El-Bostan drain water (w_1) cause rate of reduction i EC values of the investigated soils to increase. Also, magnetizing Seed Ghazy drain water caused its removal effect on soluble salts of the sand clay loam and sandy soils to increase and resulted in reduction in E values of the clayey soil i.e. it resulted in removal of soluble sal instead of increasing it upon its usage in the unmagnetized form. Th effect of using El-Hedaya irrigation canal water seemed somewhat like that of Seedy Ghazy drain water. On the other hand, Haris drain water seemed to be the least effect on leaching soluble salts out of the sandy soil. On the other hand, it caused soluble salts to accumulate in both the sandy clay loam and clayey soils.

Depthwise distribution of ***EC*** values indicated highest accumulation of soluble salts in the surface layer of all the investigated soils under all the studied water qualities.

Pattern of distribution of HCO_3^- within the different depths differed from a soil to another. HCO_3^- was detected in highest concentrations in the surface layer of both the clayey and sandy clay loam soils. Magnetization of the used waters seemed to be of no effect on HCO_3^- depthwise distribution pattern. The non-magnetization waters caused HCO_3^- to accumulate in highest concenteation in the surface layer of the sandy soil whereas the magnetized waters resulted in a HCO_3^- depthwise distribution pattern characterized by presence of HCO_3^- in a highest concentration in the deepest layer.

Concentration of Cl^- ions was highest in the surface layer of all the investigated soils, lowest in the subsurface layer and came in-between in the deepest one. No certain effect for magnetizing the water or type of the used water could be observed on redistribution of the soluble Cl^-.

SO_4^{2-} ions landed to be highest in the surface layer of all the investigated soils and decreased downwards. Neither the magnetization of the used waters not their quality could portray any change on SO_4^{2-} depthwise distribution pattern. However, accumulation of SO_4^{2-} ions in the surface layer might be due the formation of relatively in soluble sulphate salts not easily to be leached downwards.

Depthwise distribution pattern of Ca^{2+} cations seemed to l identical with that of SO_4^{2-} anions i.e. these ions where found in highe concentration in the surface layers and tended to decrease depthwis Magnitudes of Ca^{2+} concentrations though were reduced in the differe: soil depths due magnetization of water, yet pattern of depthwi: distribution of Ca^{2+} remained unaffected by this process.

Depthwise distribution pattern of a Mg^{2+} ion coincided with th of Ca^{2+} ones i.e. Mg^{2+} concentration tended to decrease downwards.

Na^+ was accumulated in highest concentration in the surface lay of all the investigated soils and tended to decrease with depth. Tl upward movement of the saline solution in drying periods among tl successive applications of the leaching water might account for such phenomenon. Magnetization seemed to be of a reducing effect (magnitudes of soluble Na^+ content in all layers of the investigated soils All the used waters whether before magnetization or after beii magnetized caused the original content of soluble K^+ in both the clay(and sandy soils to increase, yet rate of change in soil content was mo less when the magnetized waters were used.

On the other hand, the usage of such waters resulted in reducti(in the original content soluble K^+ in the sandy clay loam soil. T magnitudes of reduction and consequently rate of change in this s(content of soluble K^+ varied depending on type of the used water aı whether it was magnetized or not.

Pattern of K^+ distribution with depth seemed similar, to a gre extent, to that of Na^+ because they are of almost similar chemic properties. Thus, K^+ tended to decrease depthwise irrespect of type the water quality or the magnetization process.

3. ***Effect of magnetization of different water qualities on germination percentage and rate of wheat seeds:***

The count recorded for the germinated seeds after any period of the investigated ones was generally lower in case of usage of the non-magnetized waters than that recorded upon utilization of the magnetized one. Accordingly value of germination percentage as well as these of germination rate seemed to be higher upon utilization of the magnetized waters than the corresponding ones achieved upon utilization of the non-magnetized waters.

4. ***Effect of magnetized irrigation waters on dry weight (g pot^{-1}) of wheat plants grown on the studied soils and their uptake and concentration of N, P and K:***

Dry weight of wheat plant was highest in the clayey soil, lowest in the sandy one and came inbetween in the sandy clay loam soil. Also, it seemed that the dry matter yield was generally, highest upon irrigation with the best quality of the used water (W_1), lowest upon irrigation with the worst water (W_4) and came inbetween with the other water qualities (W_2 and W_3) with perforation for the yield attained due to irrigation with (W_2) over that attained due to irrigation with (W_3).

The dry matter yield attained due to magnetization of the used irrigation water was markedly higher the corresponding one attained due to irrigation with the non-magnetized water.

N and *K* uptake values of the plants grown on the clayey soil were generally higher than the corresponding ones of the plants grown on the calcareous soil whereas the corresponding values of the plants grown on the sandy soil were the least. Unlike N and K, values of P uptake were in the sandy clay loam soil lower than the sandy one.

Values of *N, P* and *K* uptake recorded due to usage of the different wate qualities were in the descending order: $W_1 > W_2 > W_3 > W_4$ regardless c magnetization process of these waters. However, it is of importance t indicate that the values attained due to irrigation with quality of wate after being magnetized were generally higher the corresponding one achieved due to irrigation with the same water before being nor magnetized.

Concentration of *N* in the wheat plants that were irrigated wit either of the investigated waters, it could be noticed that it wa generally lower when the used water was magnetized.

Values of ***P*** concentration seemed lowest in the plants grown on the sandy clay loam (calcareous) soil whereas those of the plants grown on the sandy one seemed higher while those of the plants grown on the clayey soil were inbetween. This occurred whether the used waters wer magnetized or not.

K concentration values in wheat plants grown on the studied soil seemed higher when these plants were irrigated with the magnetized waters than the corresponding ***K*** concentration values attained when the plants were grown with the non-magnetized waters.

5. Chemical analysis of the studied soils after removal of wheat plants:

pH values of the clayey soil tended to decrease slightly compared wi the original one recorded before cultivation. No obvious effect could l noticed on soil ***pH*** due to magnetization of the different irrigatio qualities.

Irrigation with all the water qualities caused ***EC*** value of both tl clayey and sandy soils to increase. On the other hand, cultivation of tl sandy clay loam calcareous soil using the different water qualities for irrigation resulted in marked decreases in the original *EC* value.

Relatively lower values of *EC* were attained upon irrigation with the magnetized waters than upon usage of nonmagnetized especially when the soluble salt content of water was highest (W_4).

The magnetized waters seemed to cause relatively lower HCO_3^- values as compared with the non-magnetized ones.

Soluble Cl^- contents of both the clayey and sandy soils tended generally exceed their original contents when these soils were cultivated and irrigated with the poor water qualities. The magnetized waters seemed to be of less effect on accumulation of soluble chloride in both the clayey and sandy soils than the non-magnetized ones.

Unlike what occurred in both the clayey and sandy soils, cultivation and irrigation of the sandy clay loam soil resulted in decrease in its content of soluble Cl^-. The decrease was more pronounced upon irrigation with the magnetized waters than the non-magnetized ones.

Magnetization of these waters seemed to be of a reducing effect on soil content of soluble SO_4^{2-} as compared with the non-magnetized waters.

Irrigation with all water qualities resulted in accumulation of soluble Ca^{2+} in both the clayey and sandy soils. Irrigation of the sandy clay loam soil, however, caused soluble Ca^{2+} content of this soil to decrease generally. In all cases magnetization of the used waters caused soluble Ca^{2+} content of the investigated soils to be lower as compared with the corresponding ones achieved due to usage of the non-magnetized waters.

Mg^{2+} contents of both the clayey and sandy clay loam soils increased regardless of the magnetization process which caused effect of the used waters an accumulation soluble Mg^{2+} obviously lower than tha the non-magnetized waters. Mg^{2+} content of the sandy clay loam tende to decrease as compared with the original Mg^{2+} content of this soil. Onc again the magnitudes of increase in values of soluble Mg^{2+} were reduce when the magnetized waters substituted the non-magnetized one fo irrigation.

Values of soluble Na^+ tended to increase obviously in both th clayey and sandy soils due to cultivating them with the wheat plants an irrigation with all the used water qualities. In case of the sandy cla loam soil, soluble Na^+ content increased to values higher than i original one.

K^+ content, as it was expected, increased in both the clayey an sandy soils due to their cultivation and irrigation with all qualities of th irrigation water. However, cultivation of the sandy clay loam so resulted in decrease in its soluble K^+ content. Magnetization of wat however, was of a slight effect on reducing accumulation of soluble due to irrigation with most of the used waters.

It can be concluded that the amount of salts that can be remov from soil due to leaching them increases with the initial soil salt conte Also, the fine textured soils lose less amount of their salt content th the coarser textured ones.

The ability of the applied water to carry the soil salt in its passa through soil decreased with an increase in the salt concentration of t applied water.

Application of magnetic technology in treating saline water m improve its effect on leaching soluble salts out of the salt-effected so The effect seemed to be more pronounced in the light textured soils th the heavy textured ones.

HCO_3^- became more easily to be moved down and hence to accumulate downward upon using the magnetized waters for leaching.

Magnetization of the used waters seemed to be enormous the leaching of excess soluble salts and lowering soil sodicity. However, magnetic technology can provide better soil water plant relations and is thus worth further consideration.