5. SUMMARY

The current investigation aimed at studying the variations that may take place in availability of both Fe and Mn in relation to the changes in soil redox potential. Since application of organic matter and sulfur to agricultural land is among the usual agricultural practices followed to improve physical and chemical properties of the soils, it was though to perform the experimental work involving the study of the implications of application of such materials on both the redox parameters of soils and their contents of available Fe and Mn. Two surface soil samples (0-30) were used in this study, the first one was sampled from Moshtohor to represent the Nile alluvial non-calcareous soils whereas the second one was sampled from Borg El-Arab to represent the calcareous soils. These soils are classified as Typic Torriorthents and Typic Haplocalcids, respectively which vary widely in their physical and chemical properties.

Each of the studied soils was incubated with either bagasse compost or elemental sulfur under alternate cycles of wetting and drying corresponding to saturation and 50 % depletion of the available water content, respectively. Such a moisture mode simulates, to some extent, the moisture conditions to which soil is exposed due to the successive water applications (irrigation). Rates of the applied compost were 0, 2 and 4 % whereas those of the applied elemental sulfur were 0, 0.2 and 0.4 %. The incubation continued for seven cycles. Measurements of pH and the redox potential Eh were conducted one hour after saturation for the first time, then at the wetting

stage of the first, third, fifth and seventh cycles. Corresponding set of subsamples were taken from the incubated soils were used for determining available Fe and Mn. Another set of subsamples were taken from the soils incubated without application of compost or elemental sulfur to be fractionated to follow upthe redistribution of the concerned two elements among the different soil fractions.

The results that show the effect of alternate cycles of wetting and drying and application of bagasse compost on Moshtohor soil could be summarized in the following:

* pH values seemed to be reduced due to alternate cycles of wetting and drying. The reduction was more obvious when organic matter was applied and was highest at the first cycle beyond which a case of stability had been achieved though very limited fluctuation in pH values could be noticed.
* The redox potential (Eh) and consequently the (pe) and the redox parameter (pH+pe) decreased to lowest values after the first cycle of alternate wetting and drying, however, they tended to be almost constant within the rest cycles. This occurred in absence of the applied compost as well as upon its application, yet the decreases in these values were more higher when organic matter was applied particularly at its higher rate.
* The alternate cycles of wetting and drying particularly the first one resulted in higher values of DTPA-extractable Fe as compared with those of the time zero. Application of the compost was associated with increases in values of the available Fe, however, rising rate of the applied compost from

2 to 4 % was of no detectable effect on values of DTPA-extractable Fe at the fifth and seventh cycles.

* DTPA-extractable Mn increased due to putting soil under alternate cycles of wetting and drying and application of the organic matter. It achieved its highest mean value at the third cycle thereafter tended to decrease very slightly.

Results showing the effect of application of elemental sulfur on Moshtohor soil could be boiled down in the following:

* Application of elemental sulfur to Moshtohor soil caused the effect of alternate wetting and drying cycles on reducing soil pH, Eh, pe and the overall redox parameter (pH+pe) to be remarkable. The effect was more obvious with increasing rate of the applied elemental sulfur. Values of pH, Eh and (pH+pe) were lowest at the third cycle.
* DTPA-extractable Fe increased due to application of the elemental sulfur particularly at its highest rate (0.4 %).
* Application of the elemental sulfur to the soil was associated with increase in amounts of DTPA-extractable Mn. Mn availability seemed to increase with incubation period until reaching its highest values at the third cycle of alternate wetting and drying beyond which it underwent gradual decrease.

The following is a summary of the results obtained due to treating the calcareous soil of Borg El-Arab with bagasse compost under alternate cycles of wetting and drying.

* The alternate cycles of wetting and drying resulted in decrease in each of pH, Eh, pe and (pH+pe) values.

Application of the bagasse compost caused very slight additional decrease in values of these parameters. The decrease in the aforementioned parameter was highest at the third cycle.

* Application of the compost increased the soil content of DTPA-extractable Fe, particularly upon application of the higher rate of the compost (4 %). DTPA-extractable Fe achieved its highest value at the first cycle thereafter it tended to decrease gradually.

* The effect of bagasse compost on increasing Mn availability in the calcareous soil seemed more obvious than its effect on Fe availability. The highest mean value of DTPA-extractable Mn was recorded at the first cycle beyond which Mn availability tended to decrease gradually.

The effect of applied elemental sulfur on the pH, Eh (or pe), the overall redox parameter as well as availability of both Fe and Mn in the calcareous soil of Borg El-Arab could be illustrated briefly by the following:

* In presence as well as in absence of applied elemental sulfur, one the soil was exposed to alternate cycles of wetting and drying, the pH values were decreased to minimum at the third cycle beyond which pH rose but remained slightly lower than the initial level. Patterns of changes in Eh values were similar, to a large extent, to those of pH. Application of the elemental sulfur made the reduction in pH as well as Eh and (pH+pe) more obvious particularly at its highest rate (0.4 %).

* DTPA-extractable Fe increased as a result of application of the elemental sulfur. The increase was more pronounced by

increasing rate of the applied sulfur. DTPA-extractable Fe achieved its highest value at the first cycle thereafter decreased gradually to values lower than those of the time zero. $CaCO_3$ content as well as the redox parameter might be more important in governing availability of Fe with time.

* Application of the elemental surface resulted in significant increase in soil content of DTPA-extractable Mn. DTPA-extractable Mn achieved its highest value at the end of the third cycle thereafter it tends to decrease gradually.

Hereafter, is a summary of the redistribution or transformations of Fe and Mn among the different solid phase fractions of the investigated soils:

* Due to the cycles of alternate wetting and drying, Fe was transformed from the stable, non-available forms into the labile potential available and readily available forms i.e. it changed from RES and RO fractions into ERO, CARB and EXC fractions.

* Mn transformed from the ERO to the EXC and CARB fractions in both the studied soils whereas it transformed slowly from the OM and ERO to more mobile fractions. The initial transformations of Mn among soil fractions were concomitant with changes in pH and Eh.