Iron in calcarious soils

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The present study was under taken to investigate: (i) the role of indigenous soil factors on availability of iron to monocotyledonous and dicotyledonous plants. (ii) the effect of FeSO4 and acid type fertilizer on availability of iron to soybean plants grown on low or high calcareous soils, and (iii) the impact of different amendments on soil pH and DTPA-extractable Fe in low or high calcareous soils as affected by different Fe compounds.Two pot experiments under greenhouse as well as, an incubation experiment under laboratory conditions were carried out.The first pot experiment was performed under greenhouse conditions at Agriculture Research Center to study the role of indigenous soil factors on availability of iron to monocotyledonous and dicotyledonous plants. Twenty surface soil samples were collected from the soils located in the sides of Cairo — Alexandria desert road, and one soil sample from Agriculture Research Center. Each soil samples were mixed with acid-washed sand at 1:1 ratio. One kg of each soil matrix was packed per pot. This experiment was carried out during two seasons. In the first season pots were planted with barley grains (Hordum. Vulgare L.) and the second season another pots were planted with soybean seeds (Glycine max L.). All pots were irrigated with nutrient solution free from iron. After 45 days, the plants were harvested, dry weight and macro and micronutrients were determined. The obtained results were as follows: 1- Dry matter yield of barley plants was negatively correlated with soil salinity, pH, 0.M and more significant negative correlation were observed with total and active CaCO3 content (r= - 0.776** and -0.705**).2-Active iron in barley plants was significantly correlated with both active and total CaCO3 content (r = -0.676* and -0.603”), similarly, total iron of barely plants was negatively correlated with active and total CaCO3 content (r = -0.757** and -0.796 *).3-Active iron in barely plant was positively correlated with the amorphous Fe-oxide and crystalline Fe-oxide (r = 0.672** and 0.566*). Similarly, total iron in barley plants was positively correlated with amorphous and crystalline iron oxide (r = 0.617** and 0.454*).4-Fe uptake by barley plants was positively and significantly correlated with dry weight, total Fe and active Fe concentration (r =0.657”, 0.964** and 0.773”).5-Dry matter yield of soybean was negatively correlated with total and active CaCO3 content.6-Active iron concentration of soybean plants was negatively correlated with active and total CaCO3 content (r = -0.827** and -0.880”). Similarly, total iron concentration was significantly correlated with active and total CaCO3 (r = -0.939** and -0.917”).7-There was a strong correlation between iron uptake of soybean plants with dry matter yield, total and active iron concentration (r =0.922”, 0.964** and 0.751**).The second experiment was carried out under the Same condition of the first experiments, using two soils having low or high CaCO3 content, i.e. 12% or 46% CaCO3, respectively. Forty eight plastic pots filled with each soil were packed with 10 kg air dried-soil. The rates of Fe were 0, 25 , 50 and 75 mg Fe/kg soil as FeSO4 which were banded or mixed alone or with acid-type fertilizer (10 - 30 - 0). Soybean seeds were planted in two rows, pots were irrigated twice a week. After the harvesting the plants and soil samples were taken, soil pH and DTPA-Iextractable Fe were determined. The results obtained from the experiment can be briefly summarized as follows.1-The Fe application alone had a little effect , but when banded or mixed together with acid fertilizer was more effective in increasing dry matter yield (straw, pods and grain).2-The banding technique was superior to the mixing technique at the different rates and both soils.3-Application of Fe treatments resulted in a marked increase in total and active iron concentration as well as N and K concentration. While the concentration of P, Ca, Mg, Mn and Zn were decreased in both straw and seeds.4-Addition of FeSO4 and acid-type fertilizer increased the

DTPA-extractable Fe than did $FeSO_4$ alone. Such increase were 18.1% and 14.7% at low and high calcareous soils.5-pH values slightly decreased with increasing Fe rate, this decrease was more pronounced in presence of acid-type fertilizer.Incubation experiment under laboratory condition was carried out to study the effect of different amendments on soil pH and DTPA-extractable Fe in low or high calcareous soils treated with different Fe compounds. Two soils were used to represent low and high calcareous soils, and three different amendments, i.e. poultry manure, compost and sulfur were used to study their effect on availability of iron from two sources of Fe compounds (Fe-EDDHA and $FeSO_4$). Soil samples of each treatment were taken after 5, 10, 20, 40, 80 and 160 days. Soil pH and DTPA-extractable Fe were determined. The obtained results were as follows:1- pH values of low calcareous soil under using Fe-EDDHA or $FeSO_4$ were slightly decreased with application of different amendments compared to control.2-The superiority of $FeSO_4$ in reduced pH compared to Fe-EDDHA was indicated by 1.1%, 1.1% and 0.83% for the poultry manure, compost and sulfur, respectively.3-Generally, the decreases of soil pH resulted for low calcareous soil compared to high calcareous soil were 4.68% and 4.60% for Fe-EDDHA and $FeSO_4$.4-Application of Fe-EDDHA in low calcareous soil was superior compared to $FeSO_4$ in increasing DTPA-extractable Fe , such increases were of about 108.7%, 77.6% and 97.9% for poultry manure, compost and sulfur, respectively.5-Addition of poultry manure, compost and sulfur in high calcareous soil caused relative increased in DTPA-extractable Fe of about 8.3%, 22.8% and 11.0% compared to control.6-The high calcareous soil showed lower Fe extractability compared to the low calcareous one, the extractable Fe values in highly calcareous soil were decreased by 9.0% and 67.7% for soil treated with Fe-EDDHA and $FeSO_4$, respectively.