# INTRODUCTION

Iron chlorosis is a world-wide problem, particularly in semi-arid regions where calcareous soils are widespread. The major cause of Fe deficiency is the very low solubility of the Fe-oxides, as well as its interaction with other minerals in soils. Iron in available forms in soil solution usually represents from 0.1 to 10 % of the total needed by plants, especially in calcareous soils. Iron deficiencies of agricultural crops are commonly associated with calcareous soils.

Many parts of the world have calcareous soils. In Egypt the calcareous soils are located mainly throughout the northern coastal region. This area is one of the most promising areas for agriculture expansion in Egypt. Although the area is characterized by favorable climatic conditions, the physico-chemical properties of these soils can affect the utilization of nutrients by the growing crops. In Texas, USA, calcareous soils are located mainly in the southern and western parts of the state on lands cultivated largely with sorghum , cotton, and maize. There are numerous so called " hot spots " where Fe-chlorosis is evident. Hot spots are considered to be Fe-deficient soils, so the plants growing on them exhibit severe Fe chlorosis and are unable to complete their life cycle.

Iron-deficiency symptoms are present in many orchards in the Nile valley in Egypt. Additionally, both orchard crops and field crops growing in calcareous soils in Western Noubaria often exhibit Fe deficiency symptoms. Low levels of plant-available Fe ferquently leads to less-than-optimum yields; therefore, correction of Fe deficiency in plants means an increase in crop production which, in turn, can increase the income.

Soil application of moderate rates of inorganic Fe sources generally does not correct Fe chlorosis because the applied Fe quickly forms insoluble reaction products and becomes unavailable to plants. Using Fe chelates is very expensive, particularly with field crops. Soil acidification may increase available Fe for crops. Combining FeSO4 or other Fe sources with acidic products may extend the availability of soil applied Fe. Some current commercial fertilizers consist of urea combined with $H_2SO_4$ or $H_3PO_4$. The high acidity of such products may solubilize native micronutrients including Fe and increase their availability to plants.

The objectives of this investigation were to study (i) the effect of phosphorous fertilizers on iron availability and movement, (ii) the role of $CaCO_3$ and other soil factors on iron nutrition in plants, and (iii) the reaction between soluble ferric ions and soluble phosphate ions in calcareous systems. To achieve the first objective, greenhouse and laboratory experiments were conducted using a calcareous iron deficient soil from Texas, USA. Inorganic Fe sources [ $FeSO_4$,and $Fe_2(SO_4)_3$ ] were added with / without phosphorous fertilizers, sorghum was used as indicator plant. To accomplish the second objective, soil factors such as $CaCO_3$ content, $CaCO_3$ particle size distribution, free iron oxides, amorphous iron oxides, and DTPA -extractable Fe were determined in 27 soils collected from Egypt and Texas, USA. The effect of these factors on Fe availability to soybeans which planted in these soils were studied. The third objective was largely met through laboratory experimentation, the products of the reaction between ferric and phosphate were examined by using techniques such as x-ray diffraction, transmission electron microscopy, scanning electron microscopy, and energy dispersive x-ray analysis.