SUMMARY

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In a trial to elucidate some aspects of the iron chlorosis phenomenon, the effects due to application of iron, calcium carbonate and phosphate were investigated. Three separate greenhouse experiments using a sand culture technique, with sorghum bicolor as an indicator plant, were conducted. The involved treatments can be listed as follows:

Experiment I:

Iron application as $FeSO_4$ or Fe-EDTA was performed at six rates for each source namely; 0, 5, 10, 20, 40 and 60 ppm Fe.

Experiment II:

Iron and calcium carbonate applications were carried out at rates of 0, 10 and 20 ppm Fe, as $FeSO_4$ and 0, 2, 4 and 8% $CaCO_3$.

Experiment III:

Phosphate (KH_2PO_4) application was performed at rates of 0, 20, 40 and 60 ppm P, while Fe was applied to all treatments at one rate (20 ppm Fe) as $FeSO_4$.

The determined parameters included the dry matter of sorghum (roots and shoots) as well as the concentration and total uptake of Fe, P, Ca, Mg and Mn in both plant parts.

Results can be briefly summarized as follows:

Experiment I:

At first, it may be profitable to refer that most of the rates of Fe applied in the chelated form occur beyond the optimum rate while the reverse is true in case of $FeSO_4$. Accordingly one may expect more adverse effects with Fe-EDTA than treatments with $FeSO_4$ particularly at higher rates of Fe application. In view of this sight the results, in general, showed the following:

1. Both of mineral and chelated sources of Fe (Fe-EDTA or $FeSO_4$) significantly increased sorghum dry weight yield.

2. Iron uptake by sorghum roots, shoots and hence whole plants was promoted with Fe applications showing a maximum value at a rate of about 5 ppm Fe in case of Fe-EDTA and about 20 ppm Fe in case of $FeSO_4$.

3. Results show a tendency of Fe accumulation in sorghum roots when $FeSO_4$ was the source of iron supply perhaps because of precipitation or adsorption of Fe on root surface or a relatively low mobility of the mineral Fe form as compared with the chelated one.

4. The possibility of using $FeSO_4$ as a source of Fe to growing plants was provided that higher rates than those of chelated iron are needed to compensate the various mechanisms altering Fe availability or its mobility through the plants.

5. $FeSO_4$-treated sorghum plants showed higher uptake of P in roots and whole plants than did the Fe-EDTA treated ones, but no significant differences occurred in shoots.

6. Calcium uptake by sorghum roots, was increased with increasing the levels of applied Fe. In both roots and shoots there existed more calcium uptake by treatments receiving mineral Fe than those supplied with the chelated form.

7. The concentration of Mg in sorghum roots was not affected neither by iron sources nor rates, while a significant depressive effect due to Fe application, in both forms, was observed in the shoots.

8. Both sources resulted in significant differences in total manganese uptake. In roots, shoots and whole plants. Manganese uptake by treatments receiving mineral Fe increased with increasing the rate of applied iron, but decreased in those receiving the chelated form.

9. A positive trend was revealed in sorghum shoots with respect to Fe/Mn ratio with either $FeSO_4$ or Fe-EDTA where it was more obvious.

10. A negative significant relation occurred in sorghum shoots between P/Fe ratio and rate of applied Fe-EDTA. The relation was very close to significancy in case of $FeSO_4$.

The P/Fe ratio was higher in sorghum chlorotic plants than in the normal ones.

11. The Fe/Mn ratio tended to increase gradually with increasing the rate of applied iron, but only till the maximum yield was reached.

12. The results show clearly that, leachates collected from the Fe-EDTA treated pots during the course of the experiment contained considerable amounts of leached Fe, gradually and significantly increased with increasing rates of applied Fe. On the other hand, with $FeSO_4$ treatments, minute quantities of leached Fe were recorded indicating that soluble $FeSO_4$ applied was converted into insoluble form.

13. Iron extracted from cultures by NH_4OAC pH 4.8 was increased with increasing the rate of Fe application.

14. Iron fraction extractable by 0.1 N HCl solution significantly increased with increasing the rate of applied Fe where the cultures that received $FeSO_4$ yielded higher values than those treated with Fe-EDTA.

Experiment II:

1. Results revealed that occurrence of $CaCO_3$ significantly reduced the dry matter yield of plants while it was slightly increased with Fe application.

2. Increasing levels of $CaCO_3$ drastically decreased the concentration and uptake of iron in roots, shoots and whole plants either in presence or in absence of iron.

3. Phosphorus concentration and uptake as well in roots, shoots and whole sorghum plants were adversely affected with increasing levels $CaCO_3$.

4. Calcium and magnesium uptake contained by sorghum roots significantly increased with increasing levels of $CaCO_3$, but adverse significant trend was observed in plant shoots.

5. The values of Mn uptake by sorghum roots, shoots and whole plants were significantly decreased with application of $CaCO_3$.

6. Addition of $CaCO_3$ tended to decrease the concentration and total content of P, Fe, and Mn in both sorghum roots and shoots.

. In such unbuffered sand culture, calcium carbonate seems to be an effective factor controlling the concentration and uptake of Fe, P, Ca, Mg and Mn that may give further evidence to its importance in the Fe chlorosis phenomenon.

Experiment III:

1. Phosphorus uptake by roots, shoots and whole plants was significantly increased with increasing the rate of P application.

The P/Fe ratio was higher in sorghum shoots than in sorghum roots at all levels of applied P.

2. Application of P at a rate of 20 ppm significantly promoted the total uptake of Fe, Ca and Mg, but further rates failed to yield significant increments.