IMPACT OF IRON DEFICIENCY IN FIVE LEGUME SPECIES

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Introduction

Legumes, such as soybean (*Glycine max*), common bean (*Phaseolus vulgaris*) or chickpea (*Cicer arietinum*), are important sources of nutrients, protein and essential minerals, but often legume plants are very susceptible to micronutrient deficiency, when grown in adverse conditions, like calcareous soils.

Iron is fairly abundant in soil, accounting for approximately 5% of the earth's crust [1]. However, it is often a limiting nutrient for plant growth due to the low solubility of the oxidized form of Fe (Fe^{3+}) at near neutral soil pH [2].

Since leaf chlorosis is one of the main symptoms resulting of iron deficiency and that reductase and transporter activities are inducible in roots under Fe deficiency, we grew in hydroponic conditions common bean, soybean and chickpea, as well as the model crops *Lotus japonicus* and *Medicago truncatula* under different concentrations of iron, and chlorophyll levels were monitored. Also, the ability to reduce Fe^{3+} to Fe^{2+} is reported to be higher in plants more resistant to Iron Deficiency Chlorosis (IDC), therefore, the rate of iron reduction was measured.

Materials and Methods

Plants were grown in hydroponic conditions, in the absence (0 μM Fe-EDDHA) and presence of iron (10 μM Fe(III)-EDDHA).
During 14 days, SPAD values and morphological changes were monitored.
At the end of the experiment, rates of iron reduction were measured (Figure 1A) and agarose localization assays of iron reduction (Figure 1B) were performed.

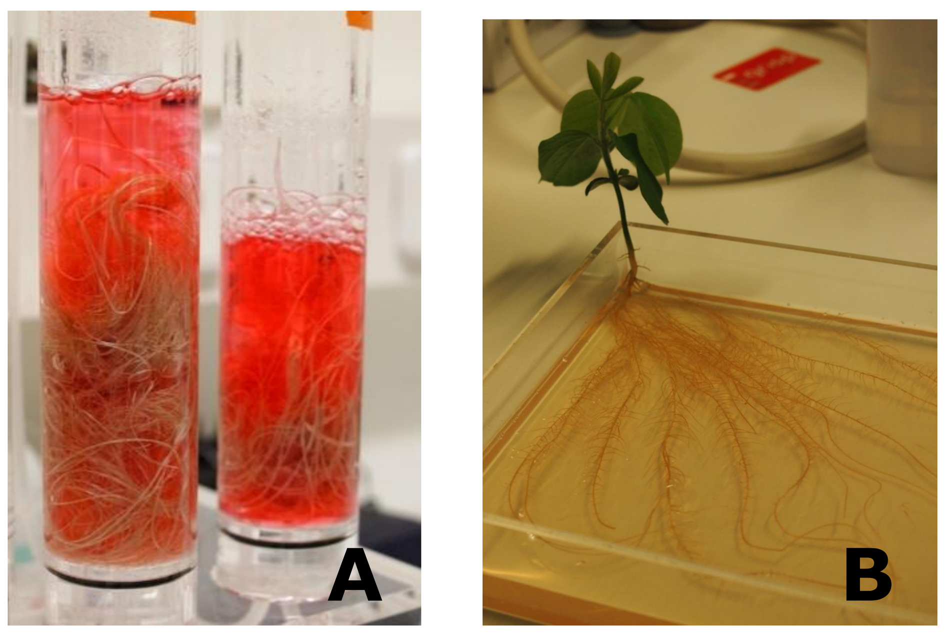

Figure 1 – A) Root-membrane iron reductase assay in *P. vulgaris* B) Agarose assay for root reductase localization in *G. max*

Results and Discussion

- ✧ Rates of iron reduction were higher in the model crops, *M. truncatula* e *L. japonicus* than in the other crops (Figure 1).
- ✧ Soybean was the plant with lower rates of reduction, which indicates, alongside with the morphological information, that this line is more susceptible to IDC.

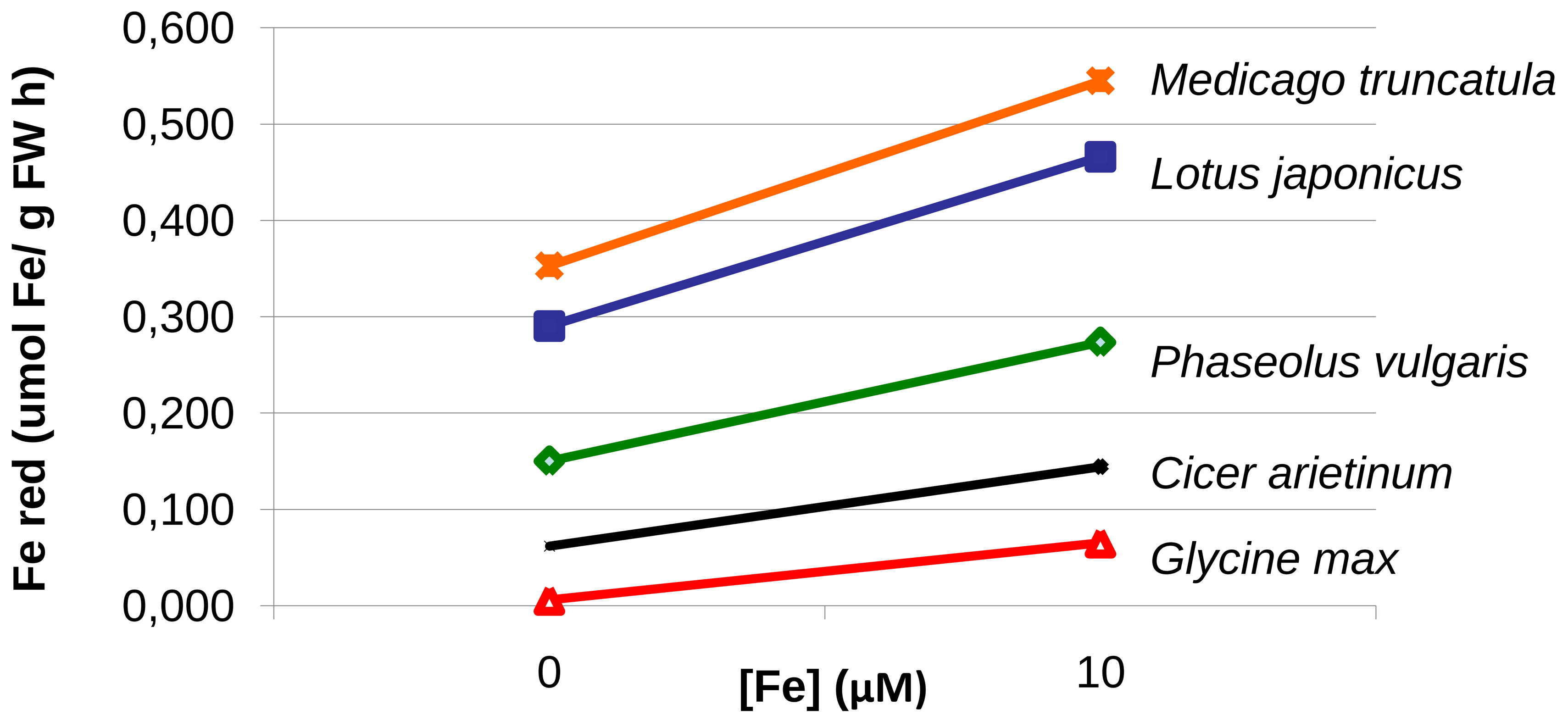

Figure 2 – Rates of iron reduction in *M. truncatula* (—), *L. japonicus* (—), *P. vulgaris* (—), *C. arietinum* (—) and *G. max* (—), in absence ([Fe]=0μM) and presence ([Fe]=10μM) of iron.

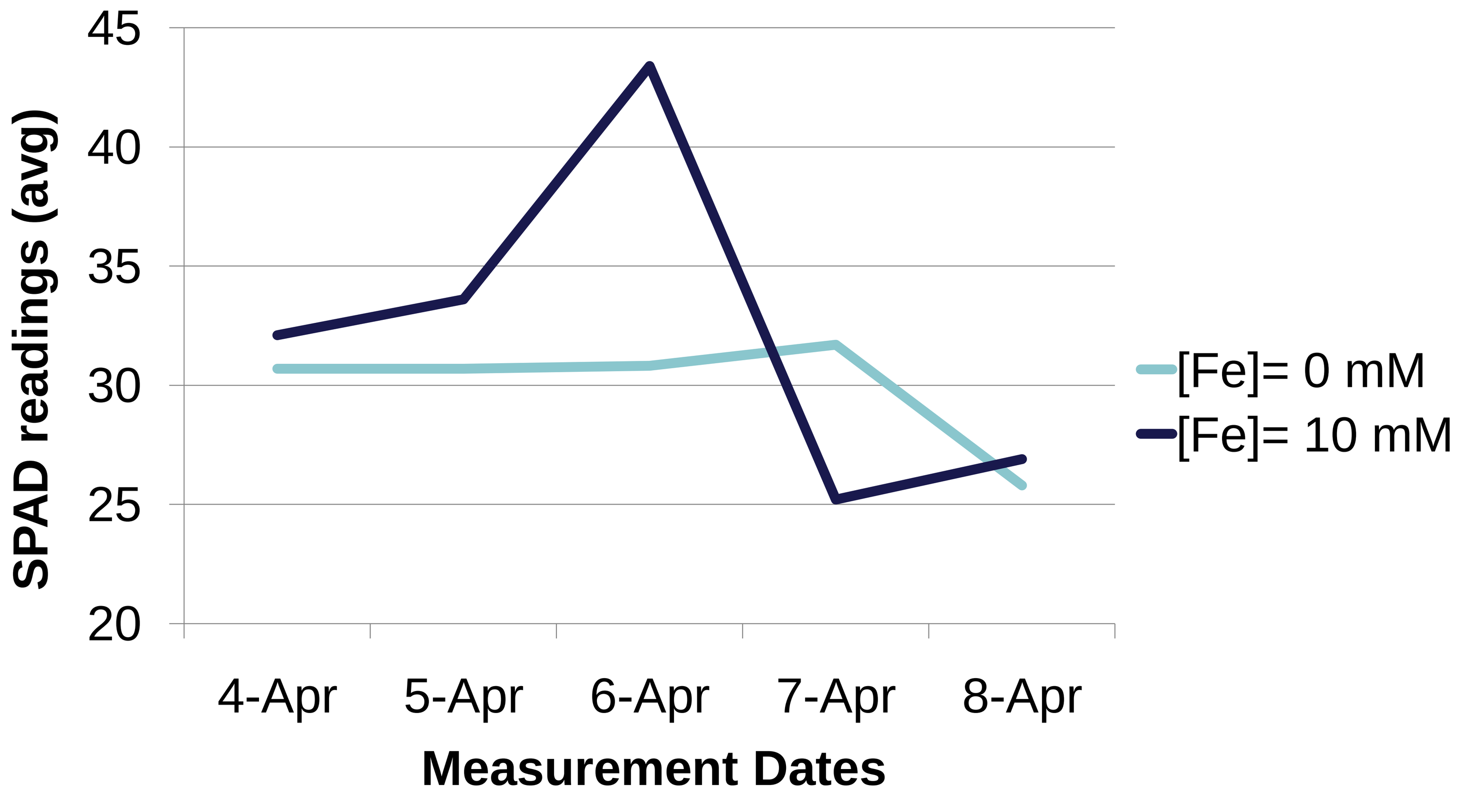

Figure 3 – SPAD readings for *G. max*.

- ✧ SPAD readings were also higher in *M. truncatula* and a distinction between plants grown in absence or presence of iron was detected (Figure 4) .
- ✧ At the end of the trial, the SPAD values in soybeans grown in the presence of iron started to diminish (Figure 3) and plants developed symptoms of IDC.

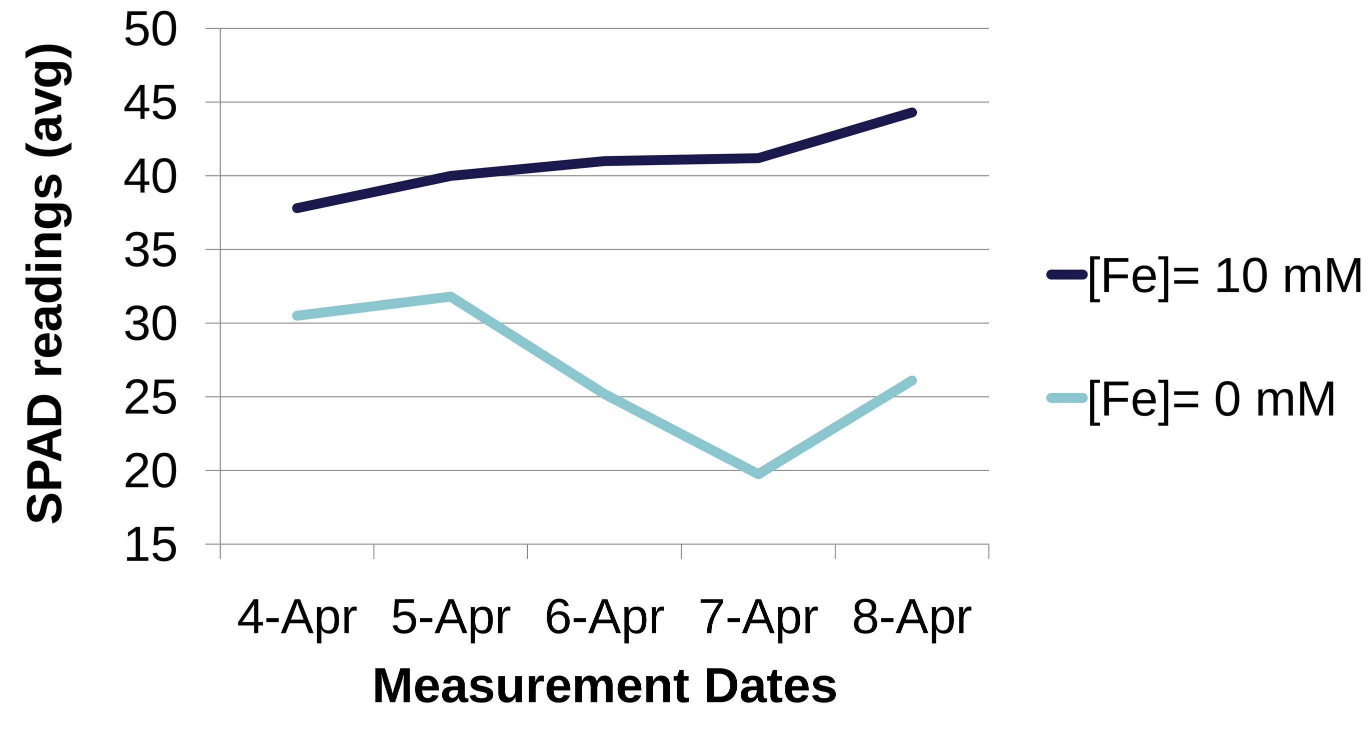

Figure 4 – SPAD readings for *M. truncatula*.

Conclusions and Future Work

✧In general, plants of the four species in study behaved differently when grown in the presence or absence of iron
✧The results show that soybean was the most susceptible plant to IDC and it is highly sensitive to iron concentration in soil;
✧Molecular studies are under course, in order to understand the relation between FRO gene, a ferric chelate reductase involved in root iron acquisition, and IDC susceptibility.

References

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