POSTDOCTORAL POSITION OFFER FORM

1. Job Position title: Optimization of ferric and phosphated fertilizers (FOSFERRO)
2. Keywords: iron; phosphorous; nutrient deficiencies; ethylene; nitric oxide; ISR microbes.
3. Researcher in charge in DAUCO:

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4. Research Group description (max. 2.000 characters)

The main research topics of our Research Group have been the regulation of Fe deficiency responses in dicot plants and the role of some factors, like bicarbonate and hypoxia, on the iron nutrition of plants. In relation to the first topic, our group was the first one to propose a role for the plant hormone ethylene in such a regulation, which has been further supported by many experimental results. After our proposal, ethylene has also been involved, both by our group and by other researchers, in the regulation of other nutrient deficiency responses, such as phosphorus, sulfur and potassium. More recently, our group found that ethylene interacts with nitric oxide, also implicated in the regulation of Fe deficiency responses by the Dr Lamattina's group, and with signals coming from the aerial part through the phloem. In the last years, our group has extended their studies to other nutrient deficiencies besides Fe, like P and S, showing that ethylene influences the crosstalk between these deficiencies. Recently, we have started to work on the relationship between Fe deficiency responses and the induced systemic response provoked by beneficial rhizosphere microbes. Some of these microbes can induce Fe deficiency responses and, in this way, facilitate Fe acquisition by the plants, acting as Fe biofertilizers (for more information, see our web page: https://www.uco.es/fethyleno/).

5. Job position description (max. 2.000 characters)

Iron (Fe) and phosphorus (P) are two essential elements for plant growth. Both elements are abundant in soils but with poor availability for plants, which favor their acquisition by developing morphological and physiological responses in their roots. Although the regulation of the genes related to these responses is not totally known, ethylene (ET) and nitric oxide (NO)

have been involved in the activation of both Fe- and P-related genes. The common involvement of ET and NO suggests that they must act in conjunction with other specific signals, more closely related to each deficiency.

This better knowledge would allow to get, in a near future, more efficient varieties in the acquisition of Fe and P and it would lead to more rational management strategies to minimize the environmental problems produced by the use of P and Fe fertilizers and to adjust farming costs.

On the other hand, several studies demonstrated that the application of some beneficial microbes to soils can improve the Fe nutrition of plants. However, the main mechanisms driving such effects are complex and not fully understood. Some of these rhizosphere microbes are also capable of eliciting the Induced Systemic Resistance (ISR) against pathogens and insects. This observation suggests that both processes (ISR and Fe deficiency responses) might be closely interconnected, and opens new possibilities for optimizing the management of the rhizosphere microbiota for improving Fe nutrition and health. However, the nodes of convergence between the two processes remain unclear. Elucidating the main nodes of interconnection between the pathways regulating microbe-elicited ISR and Fe uptake is critical for optimizing the use of plant mutualistic microbes in agriculture. The possible role of ISR microbes in relation to P nutrition has not yet been studied.

The main objectives of this proposal are:

- To study the roles and interactions of the main regulatory substances (ethylene and NO), between them and with signals coming from the aerial part, involved in P and Fe deficiency responses, to clarify the similarities and differences between both deficiencies.

- To study the possible role of the non-pathogenic strain of *Fusarium oxysporum* FO12 on the induction of several Fe and P deficiency responses.