Inocula size and salinity stress impact PGPR outcomes on maize plants

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Introduction

Freshwater availability is an increasing problem for agriculture worldwide

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Alternative: use of saline water for crop irrigation

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Problem: glycophytic plants (salt-sensitive), such as maize, are affected by salinity

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Possible solution: use of plant-growth-promoting bacteria to attenuate the effects of irrigation with salinized water

↳ Which bacteria? How many cells?

Objectives

PGPR can benefit plants under stressful conditions. However, despite having good growth-promoting traits, some fail in providing a positive effect on plants

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This failure can be related to the inoculum size applied to the plants

This work aims at:

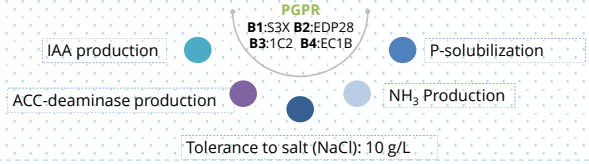
1. Assessing the effect of 4 PGPR* to promote the growth and nutritional status of maize under freshwater and saline water irrigation
2. Assessing the effect of 7 inocula sizes of each PGPR on the evaluated parameters

*B1: *Pseudomonas fluorescens* S3X; B2: *Pseudomonas reactans* EDP28; B3: *Cupriavidus necator* 1C2 ; B4: *Rhizobium radiobacter* EC1B

Experimental design and Results

01 PGPR SELECTION AND TRAITS

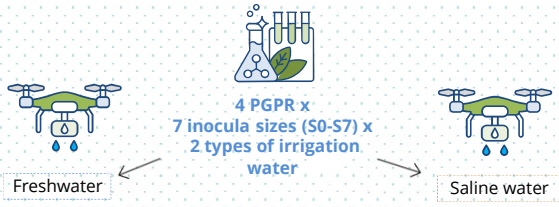
Four PGPR were selected from the institutional collection based on their *in-vitro* growth-promoting traits and their tolerance to salt:



02 GREENHOUSE EXPERIMENT

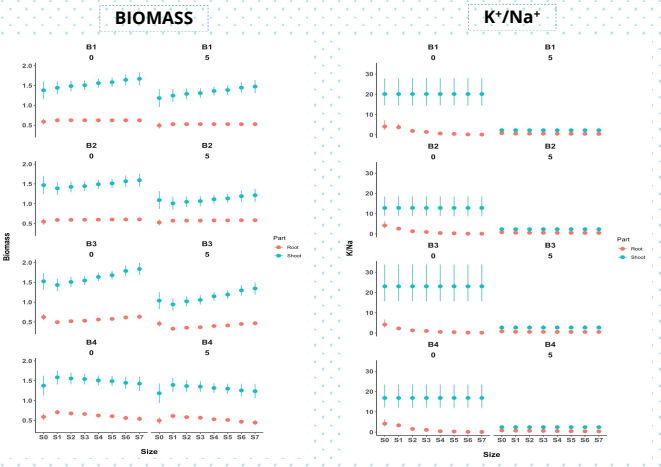
Duration: 2 months;
Plant: Maize (*Zea mays* DKC3014; FAO 220)
Soil: agricultural; non fertilized; 1kg/pot
Bacteria: B0 – control; B1; B2; B3; B4

Inocula sizes: S0: control; S1: 1e+07; S2: 5e+07; S3: 1e+08; S4: 5e+08; S5: 1e+09; S6: 5e+09; S7: 1e+10
Irrigation: freshwater and salinized water (5 g NaCl/L) from the 2nd week onwards)



03 PRELIMINARY RESULTS

Generalized linear models were fitted to the data using root- and shoot-specific biomass, and K^+/Na^+ ratios as response variables. Potential explanatory covariates were inocula size, in its linear and quadratic terms, and 2 types of irrigation water (0 and 5 g/L NaCl). All combinations between all covariates were tested (additive and interaction). The best model for each bacteria was selected based on AICc criteria.



- Globally, PGPR mitigated the effects of saline-water irrigation, although this was dependent on inocula size
- The inocula size needed to produce a beneficial effect differed for each strain, although generally showing better performance with increasing inocula sizes
- For the strain B4, the lowest inocula size was sufficient to produce a beneficial effect in biomass, with limited benefits when applied in higher sizes
- K^+/Na^+ ratio significantly decreased in plants irrigated with saline water
- In plants irrigated with freshwater, increasing sizes of PGPR tends to decrease the K^+/Na^+ ratio in roots. However, they have no effect on shoots
- No benefit of PGPR was observed in plants grown under saline water irrigation, irrespectively of the inocula size
- **SPAD** (Soil Plant Analysis Development) measures showed a beneficial impact of bacterial inoculation on plants under saline water irrigation. However, the beneficial effect of inocula size was bacterial-dependent. Vê se é isto que queres dizer

On-Going Work/Conclusions

- Other plant nutritional parameters, such as Mg, Ca, N, and P, as well as some soil parameters (*e.g.*, CEC and pH) are currently under analysis.
- This study highlights that the effect of PGPR in plant parameters (e.g., biomass) depends on the stress and on the number of cells applied

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