Impact of microbial inoculants on maize growth

Alexandra Guedes[1], Ana S. S. Sousa[1], Paula Castro[1], Sofia I.A. Pereira[1]*

[1]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Porto, Portugal

*sapereira@ucp.pt

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INTRODUCTION

⇒ World population is estimated to reach 9.7 billion by 2050, which will greatly increase the demand for food;

⇒ **The agricultural sector is facing several challenges on soil fertility and health,** related to the **negative impact of non-sustainable farming practices** and **climate change**. Essential food crops, such as **maize**, are already manifesting a decrease in growth and yield;

⇒ There is an urgent need to **develop new sustainable biotechnological tools** to increase plant growth and resilience;

⇒ **Biofertilizers including beneficial plant growth promoting (PGP) bacteria** can be a solution to restore soil fertility, health, and to increase plant development.

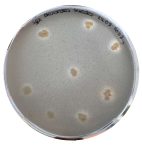
The work aims to evaluate the effect of different bacterial consortia with beneficial PGP traits on maize growth

EXPERIMENTAL DESIGN/RESULTS

Bacterial isolates PGP traits

- 9 bacterial strains previously isolated from the rhizosphere and tissues of plants growing under different environmental conditions were tested for:

P solubilization

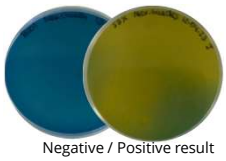


Positive result

IAA production

Ammonia production

N_2 fixing ability



Negative / Positive result

Table 1: List of tested isolates and their ability to solubilize P, fix N_2 and produce NH_3 and IAA. P solubilization indexes and IAA (µg mL^{-1}) values are expressed as means ± SD (n=3).

Bacterial strains	P solubilization	N_2-Fixation	NH_3	IAA (µg/mL)
Bacillus aryabhattai LS1-2	-	+	++	75.65 ± 5.27
Pseudomonas azotoformans IR1-5	2.37 ± 0.45	++	+++	80.23 ± 14.87
Arthrobacter nicotinovorans EAPPA	2.13 ± 0.21	+++	++	206.06 ± 15.35
Pseudomonas fluorescens S3X	2.33 ± 0.15	+++	++	208.09 ± 4.64
Rhodococcus sp. EC35	-	-	+	47.31 ± 9.23
Pseudomonas azotifigens BL01	1.83 ± 0.23	-	+	180.85 ± 33.67
Mesorhizobium sp. 3A12	-	-	+	175.85 ± 10.58
Bacillus megaterium 3AP1	-	+	++	75.23 ± 19.25
Rhizobium taibaishanense ZR3-3	-	-	+	84.50 ± 18.99

(-) negative, (+) positive/weak production, (++) moderate production, (+++) strong production.

- Based on PGP traits and biocompatibility tests, 4 consortia containing 2 strains were selected for the greenhouse trial:

2 **Mix 1:** EAPPA + S3X (50:50) 3 **Mix 2:** EAPPA + IR1-5 (50:50)

4 **Mix 3:** S3X + LS1-2 (50:50) 5 **Mix 4:** S3X + IR1-5 (50:50)

Greenhouse pot experiment

- Pots containing 600 g of agricultural soil were used (x4/treatment)
- Three maize seeds (*Zea mays* var. Dekalb) were added to each pot After germination, 10 mL (1 x 10^8 CFU/ml) of each bacterial consortium were sprayed into soil surface

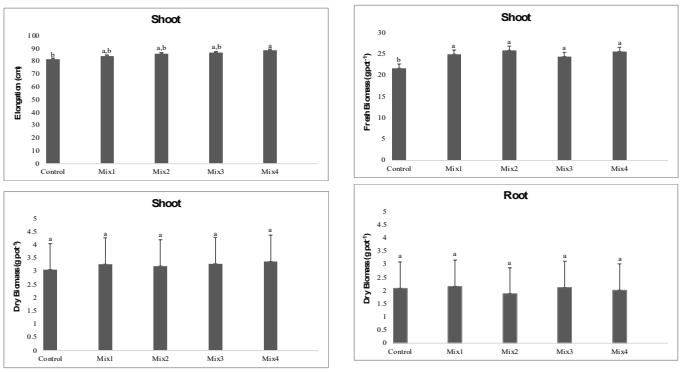


Fig. 1- Maize root and shoot biomass biometric parameters. Bars represents means (n=4) ± SD. One-way ANOVA was performed for each test condition. Means with different letters are significantly different from each other (P < 0.05) according to the Duncan test.

- A significant increase in shoot elongation was observed in pots inoculated with Mix 4

- Bacterial inoculation increased fresh shoot biomass when comparing to the control test condition

CONCLUSIONS

- Bacterial consortia promoted shoot elongation, suggesting their ability to increase plant growth and potential to be used as biofertilizers
- Significant differences in shoot fresh weight could indicate a positive water retention effect with the application of bacteria
- More research needs to be conducted to evaluate inoculants potential use in sustainable agriculture

ACKNOWLEDGEMENTS

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