Abstract

Studies have observed that the nutritional value of common crops will decrease due to the increased strain that anthropologic and industrial activities will have on the environment. Reduced natural resources in addition to a reduction in fertile farmland caused by climate change have greatly affected crop yield. As thus, an agricultural revolution is required in order to continue producing crops on an increased scale. The rhizosphere defines the region of the root-soil interface affected by the chemical processes of its host, and is a space inhabited by microorganisms. One avenue towards increasing agricultural productivity is to increase rhizosphere metabolic activity through inoculation or colonization of key plant growth promoting rhizobacteria, such as *Pseudomonas simiae,* which can release vital phytohormones and other compounds which can increase the growth rate of their host plants, such as *Brachypodium distachyon.* The Microbial Community Analysis and Function Evaluation in Soils scientific advisory board has invested in *in vitro* methods towards analysing the productivity of rhizospheric bacterial metabolic processes. The Daniel Segrè Lab used Computational Of Microbial Ecosystems in Time and Space to evaluate the growth of bacterial biomasses in soil by way of Voronoi models to simulate ectorhizospheric soil grains. The growth front of the bacterial biomass front was evaluated between dishes of varying porosity, altering both grain density and pore neck width. A basic metabolic model of *Escherichia coli* was used as a stand in for bacteria with more complex metabolic inputs and outputs. No evidence was found with current models that porosity was a significant determinant of the bacterial growth front. Additionally the first step of bacterial colonization was investigated: chemotaxis—a process by which bacteria can move towards the necessary metabolites required—using *P. simiae* as a model. Successful ring

biomass formation was made in COMETS using *P. simiae.* These are important steps towards improving *in vitro* models and towards investigating how the rhizosphere can be a way to improve nutrient uptake in a world where soil fertility is constantly declining.