CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
S1320

Project Title
Global Warming: Can Bacteria Really Help Stop It?

Abstract

Objectives/Goals
The objectives were to find optimal conditions for nitogen-fixation in the oceanic cyanobacteria Trichodesmium, with respect to irradiance and to determine if phosphorous is a limiting factor in the nitrogen-fixation process.

Methods/Materials
2 cultures of Trichodesmium with different phosphorous concentrations (5uM and 50uM) were used. For each batch, 22 vials were used and 10 mL of culture was transferred into each vial. Each vial was sealed, injected with 1.5 mL of acetylene gas and placed into a photosynthetron, one vial per well. Each well contained a different light intensity. Nitrogen-fixation was stopped by injecting .5 mL of NaOH into each vial after 2 hours. The rate of acetylene fixation was determine using gas measurements. Acetylene fixation in Trichodesmium is four times faster than nitrogen fixation.

Results
The culture containing 5 uM concentrations of phosphorous had an average peak irradiance level (level which nitrogen-fixation was greatest) of 106.88 Quanta and an average peak nitrogen fixation rate of 19.5 pmol fixed nitrogen.
The culture containing 50 uM concentrations of phosphorous had a peak irradiance level at an average of 83.13 Quanta and a peak nitrogen fixation rate at 46.29 pmol of fixed nitrogen.

Conclusions/Discussion
Phosphorous is indeed a limiting factor of Trichodesmium. The effects of iron and phosphorous as limiting factors on Trichodesmium in the ocean is being currently debated. The culture containing a greater concentration of phosphorous was able to reach a lower peak irradiance level and had a higher peak nitrogen fixation rate. One thoery is the bacteria do not need to consume extra energy to make up for a lack in phosphorous, and can instead use it for nitrogen fixation.
Recent studies have shown that there is a major correlation between oceanic nitrogen-fixing bacteria and the reduction of atmospheric carbon.
This experiment will lay down the foundation in the understandment of Trichodesmium, future lab research, and its effects of reducing global warming.

Summary Statement
Optimal conditions for nitrogen-fixation in Trichodesmium, in respect to irradiance and phosphorous levels.

Help Received
Used lab equipment at USC under the supervision of Juliette Finzi and Dr. Douglas Capone. Mentor (Juliette Finzi) advised, proof-read, supervised and helped design experimental procedure.