Optimizing Phosphorus and Iron Concentrations to Maximize Cyanobacterial Growth and Nitrogen Fixation

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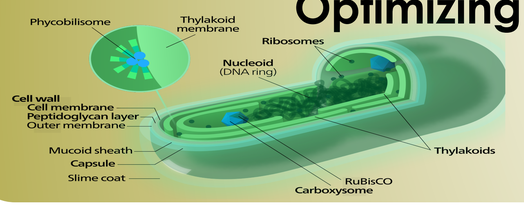
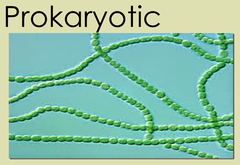


Introduction



➢Cyanobacteria are Prokaryotic Phytoplankton. These are one of few organisms can convert inert atmospheric nitrogen into an organic form, such as nitrate or ammonia. Plants need organic nitrogen for their growth.

➢Iron(Fe), and phosphorus (P), play a major role in strutting phytoplankton communities. P needed for DNA, RNA, and energy transfer. Fe a crucial for the biochemical involved in photosynthesis, and nitrogen metabolism.

➢**Objectives**
To evaluate the effect of P and Fe concentration on cyanobacterial growth and N fixation.

Materials and Methods

➢Research was conducted under laboratory conditions Lab at CSU

➢First experiment had 4 different treatments and (2 replicates):- control 100% AAI, 5%P, 25%,and 50%P in Allen-Arnon(AA) media.

➢Second experiment had 3 treatments (3 replicates) in (AA) with different concertation of P and Fe.

➢ Measurements for three week
pH.
Optical density(OD).
Total Kjeldahl nitrogen(TKN).
Inductively coupled plasma spectroscopy(ICP).
Microscopic analysis.

Acknowledgments

I extend my thanks and appreciation to Dr. Heather Storteboom, Jessica Davis, and Cyano tema for all the help in this project.

Results

First experiment
Cyanobacterial growth in media containing various concentrations of P treatments.

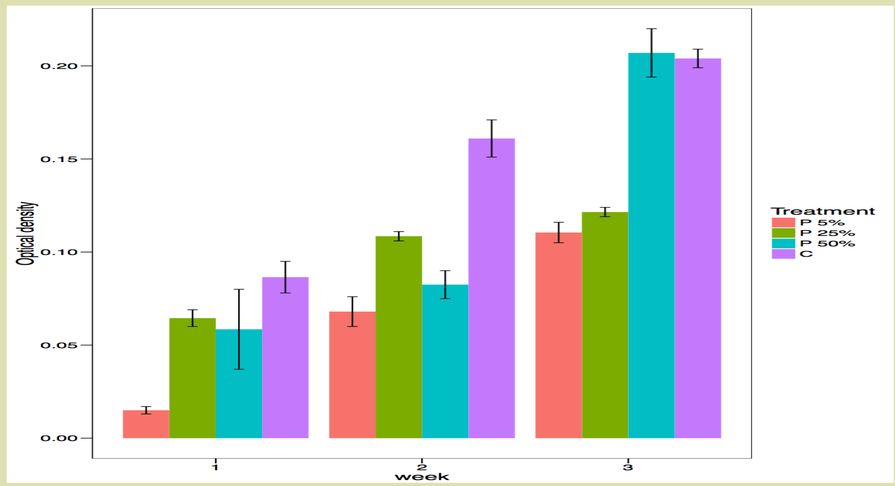


Figure1: Optical density(OD) between weeks and treatments. Error bars represent the standard error of the mean.

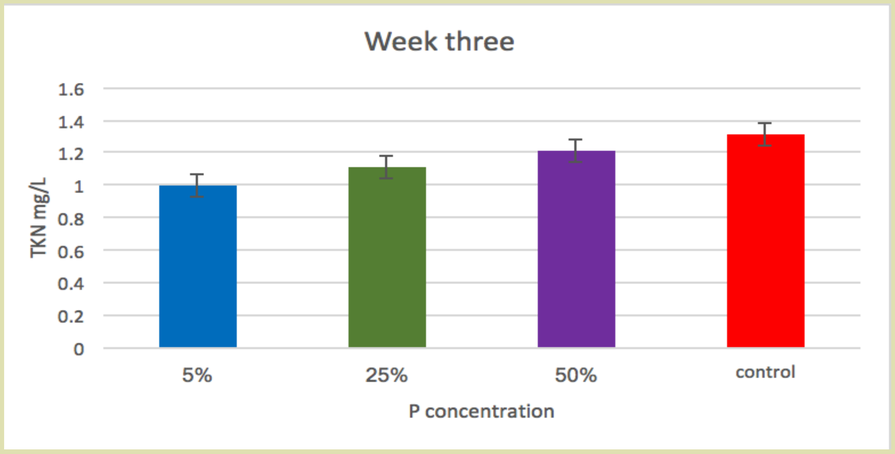


Figure2: The total Kjeldahl nitrogen(TKN) in cultures of cyanobacteria were significantly lower in 5%P. Error bars represent the standard error of the mean.

Second experiment: Cyanobacteria growth in media containing combinations of varying concentration of P and Fe.

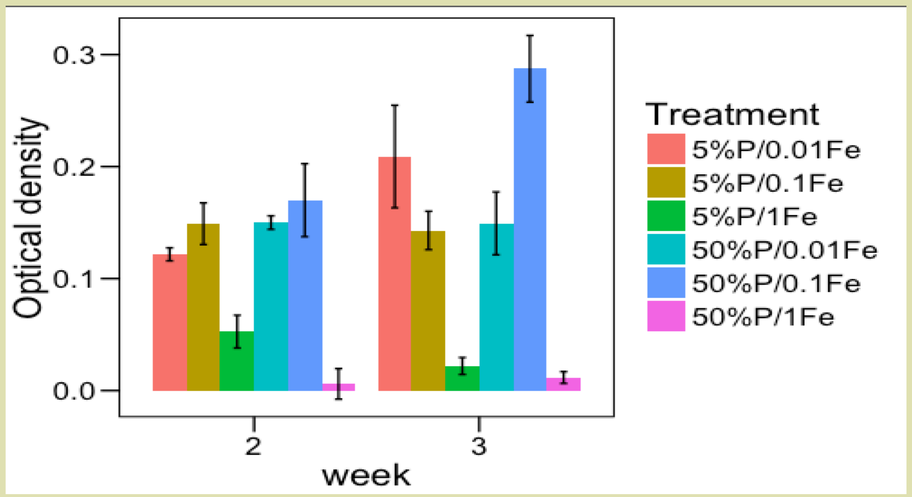


Figure 3: Optical density (OD) by week as affected by treatments.

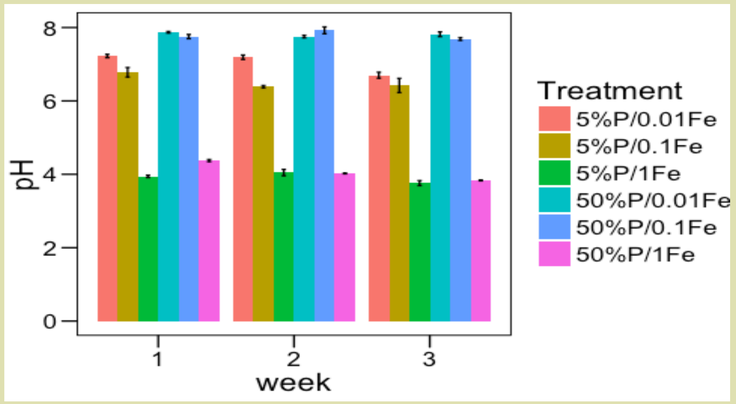


Figure4: The pH was significantly different between the treatments, (5%P,Fe 0.1), and (50%P,Fe 0.1).

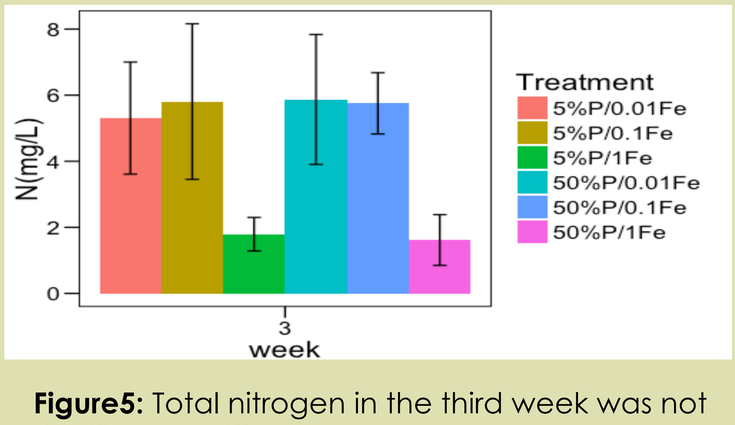
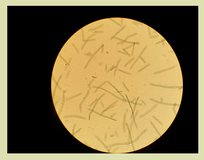
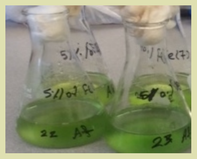


Figure5: Total nitrogen in the third week was not significantly different between the treatments. Error bars represent the standard error of the mean.

Preliminary Findings





➢Cyanobacteria does appear to have best growth in low Iron media, and (50%P) in the second experiment.
➢ The total N exhibited higher values rates as well as at lower Iron concentrations.
➢ The observed alterations in growth need for future research to know if the problem depend on low pH OR the cyanobacteria form akinetes in the absence of Iron (Hori et al.2002).

Next Step

➢ Determine if the decrease in growth of (cyanobacteria) in the second experiment from the high (Fe) or low (pH).

References

➢ Barminski, Rosalyn. *Development of an organically certifiable growth medium for N-fixing cyanobacteria in a raceway biofertilizer production system*. Diss. Colorado State University. Libraries, 2013.
➢ Hori, Katsutoshi, et al. "Behavior of filamentous cyanobacterium Anabaena spp. in water column and its cellular characteristics." *Biochemical engineering journal* 10.3 (2002): 217-225