



Spyrogyra, Chara, and Zygnema Nitrogen Uptake

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Abstract

Due to the abundant agricultural runoff, high levels of nitrogen have been found in the Lake Waco Wetlands. This study was conducted to compare the nitrogen fixation rates of *Zygnema* sp., *Spirogyra* sp., and *Chara* sp. Three 5 g samples of each genera were grown with the same amount of Nitrogen in artificial mesocosms. The Nitrogen levels were measured using a HACH DR/890 colorimeter 4 times over a 12 day period of time and analyzed. Results showed that there is no statistical significance between the three genera, but this study shows there is room for further experimentation.

Introduction

Some genera of algae fix nitrogen into ammonium gas and other molecules through a reaction catalyzed by the enzyme nitrogenase (Arp, 1999). Some of these genera can be found in the Lake Waco Wetlands in central Texas (Scott et al. 2007). This project will determine which of three genera fixes nitrogen at the quickest rate. Such information has the potential to influence Waco Wetlands management practices; the presence of algal genera that demonstrate significantly higher rates of nitrogen fixation than others could be deliberately encouraged in the Wetlands to curb the abnormally high nitrogen levels found in the nearby North Bosque River (Scott et al, 2008). The hypothesis is *Spirogyra* sp. will have the highest rate of nitrogen fixation.

Materials & Methods

For each genera, *Spirogyra* sp., *Zygnema* sp., and *Chara* sp., three 5 g samples were measured using an analytical balance. Each sample was placed in a 25.6 L container with 4 L of deionized water (Figure 3). A stock solution was made with 200 mg of 21-0-0 fertilizer and 3.5 L of deionized water. For each container, 25 mL of nitrogen stock solution was added. The algae was grown for 12 days under 24 hour artificial light as well as air pumps.

The nitrate levels in each of the nine mesocosms was measured four times over the course of 12 days using a HACH DR/890 colorimeter. The High Nitrate Test was used for the first reading, the Medium Nitrate Test was used for the second reading, and the Low Nitrate Test was used for the last two readings.



Figure 1: Nitrogen Testing

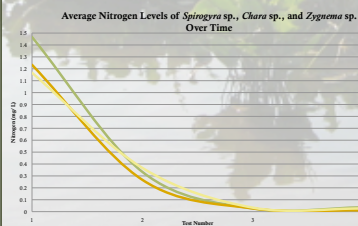


Figure 2: Sample Collection



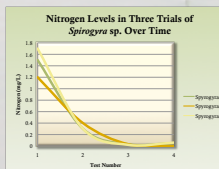
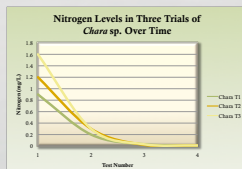
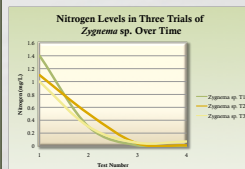
Figure 3: Experimental Set up

Results



The fixation rates of each sample were calculated and averaged for each genera. These rates were compared using an ANOVA test, which deemed the difference between the average rates not statistically significant ($p = .4369$).

Spirogyra sp.'s average fixation rate was 1.45, *Zygnema* sp.'s was 1.14, and *Chara* sp.'s was 1.22. [Rates measured in mg/L/12 days]



Discussion & Conclusions

The results demonstrate there is no significant difference between the fixation rates of *Spirogyra* sp., *Zygnema* sp., and *Chara* sp.. The lack of statistical significance is possibly due to the low sample size and the length of time between each reading. Future studies should improve on these points to generate more reliable nitrogen fixation rates. This study has merit insofar as it compares nitrogen fixation rates between algal genera not previously compared in the Lake Waco Wetlands. While this study did not produce statistically significant results, it did demonstrate differences between the genera and found specific points of improvement for future studies.

Literature Cited

Arp, D.J. (2000). The Nitrogen Cycle. *Prokaryotic nitrogen fixation: a model system for analysis of a biological process*. Wymondham, UK: Horizon Scientific Press.

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